# South Carolina Department of Health and Environmental Control

## Environmental Surveillance Oversight Program
## Data Report for 2006

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

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**Region 5**
**Environmental Quality Control**
**Serving:** Aiken, Allendale, Bamberg, Barnwell, Calhoun, and Orangeburg Counties

*Promoting Health, Protecting the Environment*

# Introduction

DHEC's Environmental Surveillance and Oversight Program (ESOP) supports and complements SCDHEC's comprehensive regulatory program at The Savannah River Site by focusing on those activities not supported or covered through our normal regulatory framework. The primary function of the ESOP is to evaluate the effectiveness of SRS monitoring activities. To accomplish this function, the ESOP conducts non regulatory monitoring activities on and around the SRS, conducts evaluations of the SRS monitoring program and provides an independent source of information to the public pertaining to levels of contaminants in the environment from historical and current SRS operations.

This report includes a description of the ESOP's multi-media monitoring network and activities along with a summary of the findings of the ESOP from the 2006 calendar year monitoring period.

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# List of Acronyms

| | |
|---|---|
| **BNL** | Brookhaven National Laboratory |
| **CDC** | Centers for Disease Control |
| **Cs-137** | Cesium-137 |
| **CSWTF** | Central Sanitary Wastewater Treatment Facility |
| **DER** | Duplicate Error Ratio |
| **DOE-SR** | Department of Energy - Savannah River |
| **DRF** | Dose Reduction Factor |
| **DW** | Drinking Water |
| **EPA** | Environmental Protection Agency |
| **EQC** | Environmental Quality Control |
| **ESOP** | Environmental Surveillance and Oversight Program |
| **ETF** | Effluent Treatment Facility |
| **FGR** | Federal Guidance Report |
| **GW** | Groundwater |
| **HLW** | High Level Waste |
| **ICRP** | International Commission on Radiological Protection |
| **LLD** | Lower Limit of Detection |
| **LLNL** | Lawrence Livermore National Laboratory |
| **MCL** | Maximum Contaminant Level |
| **MDA** | Minimum Detectable Activity |
| **MDC** | Minimum Detectable Concentration |
| **MEI** | Maximally Exposed Individual |
| **MFC** | Membrane Fecal Coliform |
| **MSRP** | Miscellaneous Rubble Pile |
| **NORM** | Naturally Occurring Radioactive Material |
| **NRC** | Nuclear Regulatory Commission |
| **ORNL** | Oak Ridge National Laboratory |
| **ORWBG** | Old Radioactive Waste Burial Ground |
| **PRG** | Preliminary Remediation Goals |
| **PWS** | Public Water System |
| **QA/QC** | Quality Assurance / Quality Control |
| **REMD** | Radiological Environmental Monitoring Division |
| **RW** | River Water |
| **SCDHEC** | South Carolina Department of Health and Environmental Control |
| **SCDNR** | South Carolina Department of Natural Resources |
| **SD** | Standard Deviation |
| **SE** | Site Evaluation |
| **SOP** | Standard Operating Procedure |
| **SRS** | Savannah River Site |
| **SRSHES** | Savannah River Site Health Effects Subcommittee |
| **STL** | Severn Trent Laboratories |
| **SW** | Surface Water |
| **TAL** | Target Analyte List |
| **TEF** | Tritium Extraction Facility |

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# List of Acronyms

| | |
|---|---|
| **TLD** | Thermoluminescent Dosimeter |
| **TSP** | Total Suspended Particle |
| **WSRC** | Washington (formerly Westinghouse) Savannah River Company |

## Units of Measure

| | |
|---|---|
| **cm** | centimeter |
| **$g/cm^3$** | grams per cubic centimeter |
| **hr/day** | hour per day |
| **hr/yr** | hour per year |
| **kg/yr** | kilograms per year |
| **L** | Liter |
| **L/hr** | Liters per hour |
| **L/yr** | Liters per year |
| **$m^3/yr$** | Cubic meters per year |
| **mg/day** | milligrams per day |
| **mg/kg** | milligrams per kilogram |
| **mg/L** | milligrams per liter |
| **mL** | milliliter |
| **mrem** | milliroentgen equivalent man |
| **pCi/g** | picocuries/gram |
| **pCi/L** | picocuries/liter |
| **$pCi/m^3$** | picocuries per cubic meter |
| ± | plus or minus one standard deviation unless otherwise noted |

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# List of Acronyms

## Radionuclides and Associated Half-Lives

| | | |
|---|---|---|
| Ac-228 | Actinium-228 | 6.1 hours (h) |
| Am-241 | Americium-241 | 432 years (y) |
| Ar-41 | Argon-41 | 1.83 h |
| C-14 | Carbon-14 | 5730 y |
| Ce-144 | Cerium-144 | 284 days (d) |
| Cs-134 | Cesium-134 | 2.06 y |
| Cs-137 | Cesium-137 | 30.1 y |
| Cm-242 | Curium-242 | 163 d |
| Cm-243 | Curium-243 | 28.5 y |
| Cm-244 | Curium-244 | 18.1 y |
| Cm-245 | Curium-245 | 8.5E3 y |
| Cm-246 | Curium-246 | 4.75E3 y |
| Co-57 | Cobalt-57 | 271 d |
| Co-60 | Cobalt-60 | 5.27 y |
| Eu-154 | Europium-154 | 8.8 y |
| Eu-155 | Europium-155 | 4.96 y |
| H-3 | Hydrogen-3 (tritium) | 12.3 y |
| I-129 | Iodine-129 | 1.57E7 y |
| I-131 | Iodine-131 | 8.04 d |
| I-133 | Iodine-133 | 20.9 h |
| K | Potassium-40 | 1.27E9 y |
| Kr-85 | Krypton-85 | 10.7 y |
| Mg-54 | Magnesium-54 | 312.5 d |
| Na-22 | Sodium-22 | 2.6 y |
| Nb-95 | Niobium-95 | 35.0 d |
| Ni-63 | Nickel-63 | 100y |
| Np-237 | Neptunium-237 | 2.14E6 y |
| Pb-212 | Lead-212 | 10.64 h |
| Pb-214 | Lead-214 | 27 m |
| P-32 | Phosphorus-32 | 14.3 d |
| Pm-146 | Promethium-146 | 5.5 y |
| Pu-238 | Plutonium-328 | 87.7 y |
| Pu-239 | Plutonium-329 | 2.4E4 y |
| Pu-240 | Plutonium-240 | 6.5E3 y |
| Ra-226 | Radium-226 | 14.8 d |
| Ra-228 | Radium-228 | 5.75 y |
| Ru-103 | Ruthenium-103 | 39 d |
| Ru-106 | Ruthenium-106 | 1.00 y |
| S-35 | Sulfur-35 | 87.4 d |
| Se-79 | Selenium-79 | 6.5E4 y |
| Sb-125 | Antimony-125 | 2.77 y |

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# List of Acronyms

| | | |
|---|---|---|
| Sn-113 | Tin-113 | 115 d |
| Sn-126 | Tin-126 | 1.0E5 y |
| Sr-89 | Strontium-89 | 50.6 d |
| Sr-90 | Strontium-90 | 28.8 y |
| Tc-99 | Technetium-99 | 2.13E5 y |
| Th-228 | Thorium-228 | 1.9 y |
| Th-230 | Thorium-230 | 7.7E4 y |
| Th-232 | Thorium-232 | 1.41E4 y |
| Th-234 | Thorium-234 | 24.1 d |
| Tl-208 | Thallium-208 | 3.05 minutes |
| U-233 | Uranium-233 | 1.59E5 y |
| U-234 | Uranium-234 | 2.44E5 y |
| U-235 | Uranium-235 | 7.03E8 y |
| U-238 | Uranium-238 | 4.47E9 y |
| Y-91 | Yttrium-91 | 58 d |
| Zn-65 | Zinc-65 | 244 d |
| Zr-95 | Zirconium-95 | 64.0 d |

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# Sampling Location Information

Note: Quadrant locations for DOE-SR Environmental perimeter random soil samples collected in 2004. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.

| **DOE-SR Environmental Perimeter** | | **Quadrant (Quad) Limits** |
|---|---|---|
| **Random Quadrants Within SRS Perimeter "E"** | | **Inside of the 50-mile SRS Perimeter Zone.** |
| **Quad Designation** | **7.5' Quad Name** | **Latitude by Lat and Longitude by Long** |
| **E1X** | Furman | 3237.5 by 3245 and -8107.5 by -8115 |
| **E2** | Barnwell | 3307.5 by 3315 and -8115 by -8122.5 |
| **E3X** | New Ellenton, SE | 3315 by 3322.5 and -8130 by -8137.5 |
| **E4** | Aiken | 3330 by 3337.5 and -8137.5 by -8145 |
| **E5** | Ehrhardt | 3300 by 3307.5 and -8100 by -8107.5 |
| **E6** | Foxtown | 3337.5 by 3345 and -8130 by -8137.5 |
| **E7X&B24X** | Emory | 3352.5 by 3400 and -8137.5 by -8145 |
| **E8** | HarleysMillPond | 3330 by 3337.5 and -8107.5 by -8115 |
| **E9** | Monetta | 3345 by 3352.5 and -8130 by -8137.5 |
| **E10** | Norway West | 3322.5 by 3330 and -8107.5 by -8115 |
| **E11** | North | 3330 by 3337.5 and -8100 by -8107.5 |
| **E12** | Colliers | 3337.5 by 3345 and -8200 by -8207.5 |
| **E13** | Norway East | 3325.5 by 3330 and -8100 by -8107.5 |
| **E14X** | Jackson | 3315 by 3322.5 and -8145 by -8152.5 |
| **E15X** | Evans | 3330 by 3337.5 and -8207.5 by -8215 |
| **E16** | Denmark | 3315 by 3322.5 and -8107.5 by -8115 |
| **E17X&B25X** | Orangeburg S. | 3322.5 by 3330 and -8045 by -8052.5 |
| **E18** | Midway | 3315 by 3322.5 and -8052.5 by -8100 |
| **E19X** | Mechanics Hill | 3315 by 3322.5 and -8152.5 by -8200 |
| **E20** | Kitchens Mill | 3330 by 3337.5 and -8122.5 by -8130 |
| **E21** | Clear Pond | 3307.5 by 3315and -8100 by -8107.5 |
| **E22X&B26X** | Grays | 3237.5 by 3245 and -8100 by -8107.5 |
| **E23** | Kildaire | 3230 by 3237.5 and -8122.5 by -8130 |
| **E24** | Long Branch | 3315 by 3322.5 and -8122.5 by -8130 |
| **E25** | Clarks Hill | 3337.5 by 3345 and -8207.5 by -8215 |
| **E26X&B27X** | Parksville | 3345 by 3352.5 and -8207.5 by -8215 |
| **E27** | Roper's Crossroads | 3337.5 by 3345 and -8152.5 by -8200 |
| **E28** | Salley | 3330 by 3337.5 and -8115 by -8122.5 |
| **E29** | Allendale | 3300 by 3307.5 and -8115 by -8122.5 |
| **E30** | Graniteville | 3330 by 3337.5 and -8145 by -8152.5 |
| **E31** | Oakwood | 3330 by 3337.5 and -8130 by -8137.5 |
| **E32** | Martinez | 3330 by 3337.5 and -8200 by -8207.5 |
| **E33X** | Snellings | 3307.5 by 3315 and -8122.5 by -8130 |
| **E34X&B41** | Gilbert | 3352.5 by 3400 and -8122.5 by -8130 |
| **E35** | Steedman | 3345 by 3352.5 and -8122.5 by -8130 |
| **E36** | Springfield | 3322.5 by 3330 and -8115 by -8122.5 |
| **E37** | Sycamore | 3300 by 3307.5 and -8107.5 by -8115 |
| **E38** | Brier Creek Island | 3245 by 3252.5.5 and -8122.5 by -8130 |
| **E39** | Bull Pond | 3252.5 by 3300 and -8122.5 by -8130 |

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter random environmental sampling.
4. "**B**" means this is a background pick outside of the 50 mile SRS perimeter limit.

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# Sampling Location Information

**Note: Quadrant locations for South Carolina background random soil samples collected in 2004. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.**

| **South Carolina Background** | | **Quadrant (Quad) Limits** |
|---|---|---|
| **Random Quadrants for the S.C. Bkg "B"** | | **Outside of the 50-mile SRS Perimeter Zone.** |
| **Quad Designation** | **7.5' Quad Name** | **Latitude by Lat and Longitude by Long** |
| **B1X** | Cashiers | 3500 by 3507.5 and -8300 by -8307.5 |
| **B2X&E1X** | Furman | 3237.5 by 3245 and -8107.5 by -8115 |
| **B3** | Felderville | 3322.5 by 3330 and -8030 by -8037.5 |
| **B4** | James Is. | 3237.5 by 3245 and -7952.5 by -8000 |
| **B5** | Carlisle | 3430 by 3437.5 and -8122.5 by -8130 |
| **B6** | Antreville | 3415 by 3422.5 and -8230 by -8237.5 |
| **B7X** | Saluda | 3507.5 by 3515 and -8215 by -8222.5 |
| **B8** | Bingham | 3422.5 by 3430 and -7930 by -7937.5 |
| **B9** | Alvin | 3315 by 3322.5 and -7945 by -7952.5 |
| **B10** | Jamestown | 3315 by 3322.5 and -7937.5 by -7945 |
| **B11** | North Is. | 3315 by 3322.5 and -7907.5 by -7915 |
| **B12** | Summerton | 3330 by 3337.5 and -8015 by -8022.5 |
| **B13** | Sharon | 3452.5 by 3500 and -8115 by -8122.5 |
| **B14X** | Lake Murray E | 3400 by 3407.5 and -8115 by -8122.5 |
| **B15** | Spring Is. | 3215 by 3222.5 and -8045 by -8052.5 |
| **B16X** | Westminster | 3437.5 by 3445 and -8300 by -8307.5 |
| **B17X** | Hartwell Dam | 3415 by 3422.5 and -8245 by -8252.5 |
| **B18X** | Hartsville South | 3415 by 3422.5 and -8000 by -8007.5 |
| **B19** | Salters | 3330 by 3337.5 and -7945 by -7952.5 |
| **B20X** | Pineland | 3230 by 3237.5 and -8107.5 by -8115 |
| **B21** | Mayesville | 3352.5 by 3400 and -8007.5 by -8015 |
| **B22** | Carlisle SE | 3430 by 3437.5 and -8115 by -8122.5 |
| **B23** | Outland | 3337.5 by 3345 and -7915 by -7922.5 |
| **B24X&E7X** | Emory | 3352.5 by 3400 and -8137.5 by -8145 |
| **B25X&E17X** | Orangeburg S. | 3322.5 by 3330 and -8045 by -8052.5 |
| **B26X&E22X** | Grays | 3237.5 by 3245 and -8100 by -8107.5 |
| **B27X&E26X** | Parksville | 3345 by 3352.5 and -8207.5 by -8215 |
| **B28** | Lake City West | 3345 by 3352.5 and -7945 by -7952.5 |
| **B29** | Neyles | 3245 by 3252.5 and -8030 by -8037.5 |
| **B30** | Oak Grove | 3415 by 3422.5 and -7930 by -7937.5 |
| **B31** | Hardeeville | 3215 by 3222.5 and -8100 by -8107.5 |
| **B32X** | Saluda South | 3352.5 by 3400 and -8145 by -8152.5 |
| **B33** | Bradley | 3400 by 3407.5 and -8207.5 by -8215 |
| **B34** | Greenwood | 3407.5 by 3415 and -8207.5 by -8215 |
| **B35** | Limestone | 3352.5.5 by 3400 and -8200 by -8207.5 |
| **B36** | Abbeville East | 3407.5 by 3415 and -8215 by -8222.5 |
| **B37** | Calhoun Creek | 3400 by 3407.5 and -8222.5 by -8230 |
| **B38** | Laurens North | 3430 by 3437.5 and -8200 by -8207.5 |
| **B39** | Saluda North | 3400 by 3407.5 and -8145 by -8152.5 |

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter random environmental sampling.
4. "**B**" means this is a background pick outside of the 50 mile SRS perimeter limit.

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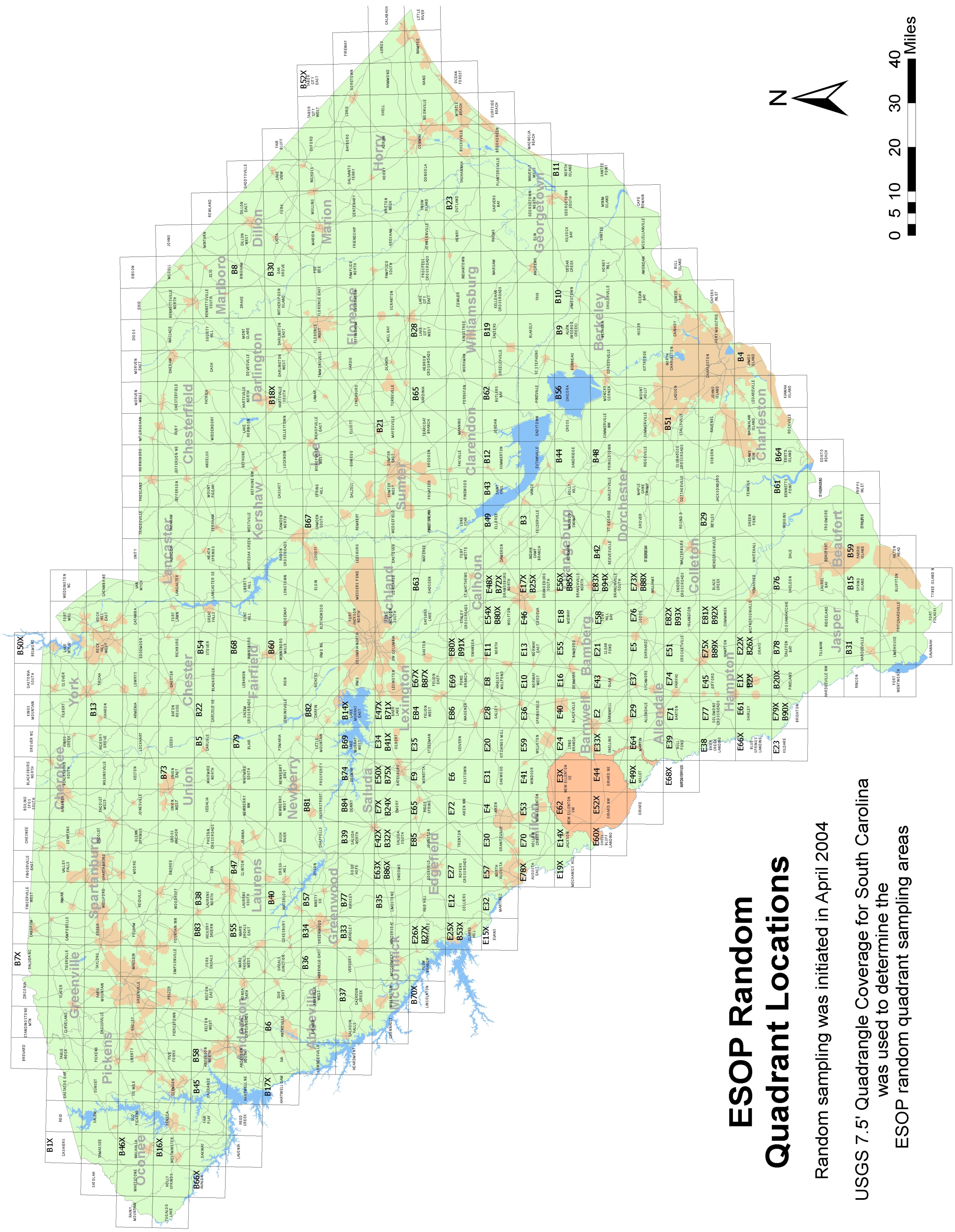
# Sampling Location Information

Map 1. Savannah River Site perimeter and South Carolina background random sampling locations chosen to date. Not all locations have been sampled. **Back to Maps**



## 1.1 Atmospheric Radiological Monitoring

### 1.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) provides independent quantitative monitoring of ambient atmospheric radionuclide releases associated with the Savannah River Site (SRS). It also provides monitoring of atmospheric media on a routine basis to measure radionuclide concentrations in the surrounding environment and to identify trends that may require further investigation. Radiological atmospheric monitoring sites are established to provide spatial coverage of the project area (Map 2, section 1.1.2).

The ESOP air monitoring capabilities in 2005 included air monitoring stations with the capacity for sample collection of glass fiber filters, precipitation, and silica gel columns, and thermoluminescent dosimeters (TLDs). The glass fiber filters were used to collect total airborne particulates. Particulates were screened weekly for gross alpha and gross beta emitting activity. Precipitation, when present, was sampled and analyzed monthly for tritium. Silica gel distillates of atmospheric moisture were analyzed monthly for tritium. TLDs were collected and analyzed every quarter for ambient beta/gamma levels. ESOP emphasizes monitoring for radionuclides in atmospheric media around the SRS at potential public exposure locations. A background air monitoring station was established in Beaufort, SC to provide data on ambient radiation for baseline and trend analysis.

ESOP data collected substantiated historically reported Department of Energy-Savannah River (DOE-SR) values for radionuclides in the ambient environment at or near the SRS boundary.

In general, average ESOP atmospheric radiological monitoring results at the SRS boundary are slightly different than DOE-SR reported average values. Variations in atmospheric radiological monitoring results between ESOP and DOE-SR are likely a result of differences in monitoring locations, local meteorological conditions, frequency and number of locations.

In summary, no United States Environmental Protection Agency (USEPA) air standards were exceeded at the monitored locations. Sampling results by ESOP indicate that SRS activities had a measurable, but an inconsequential impact on local air quality.

**RESULTS AND DISCUSSION**

Total Suspended Particulates (TSP)

Routine weekly data for TSP can be found in section 1.1.4.

Alpha

During the 2006 sampling period, gross alpha activity ranged from 0.001 to 0.036 pCi/m$^3$. Values in this range are typically associated with naturally occurring alpha-emitting radionuclides, primarily as decay products of radon (Kathren 1984), and are considered normal. If gross alpha counts are above the range of 0.7 pCi/m$^3$, which is the action level according to Rhonda Sears (telephone conversation, September 17, 2005) of the EPA, the filters are analyzed for specific radioisotopes. The average gross

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alpha nuclide concentration in 2006 was 0.003 ± 0.001 $pCi/m^3$. The ESOP gross alpha activity average is within three standard deviations of the DOE-SR gross alpha average of 0.001 $pCi/m^3$.

Beta

During the 2006 sampling period, gross beta concentrations ranged from 0.002 to 0.058 $pCi/m^3$. Values in this range are typically associated with naturally occurring beta-emitting radionuclides, primarily as decay products of radon (Kathren 1984). Small seasonal variations at each monitoring location have been consistent with historically reported ESOP values (SCDHEC 2006). The EPA, Office of Radiation and Indoor Air, uses gross beta counts as an indicator to determine if additional analyses will be performed. A gamma scan is done if the gross beta activity exceeds 1 $pCi/m^3$. This is the tiering of definitive analyses that is used for all total suspended particulate sampling associated with the Environmental Radiation Ambient Monitoring System (ERAMS). The ERAMS is comprised of a nationwide network of sampling stations that identify trends in the accumulation of long-lived radionuclides in the environment (U.S. EPA 2004a). Section 1.1.3 Figure 1 shows average gross beta activity for SRS perimeter locations and illustrates trending of gross beta values for ESOP and DOE-SR (WSRC 2005). The average gross beta concentration reported by ESOP in 2006 was 0.024 ± 0.002 $pCi/m^3$. The SCDHEC gross beta activity average is within four standard deviations of the DOE-SR gross beta average of 0.016 $pCi/m^3$ .

**Radiochemical Particulates**

First quarter glass filters were analyzed for plutonium-238, plutonium-239/40, americium-241, and strontium-89/90 in 2004. All analytical results for these radioisotopes were below Minimum Detectable Activity (MDA) or below the Reporting Limit of Eberline.

Ambient Beta/Gamma

ESOP conducts ambient beta/gamma monitoring through the deployment of TLDs around the perimeter of the SRS. During the sampling period, SCDHEC external radiation levels at monitored locations were lower than levels reported by DOE-SR (WSRC 2007). Ambient beta/gamma levels measured with TLDs are provided for all quarters of 2006 in section 1.1.4. It should be noted that 4 mrem are subtracted from the reported result for each TLD to account for the transcontinental flight from South Carolina to California and back (Walter 1995). Corrected values are reported in Appendix C. The average ambient beta/gamma activity in 2006 was 27 ± 2 mrems.

Figure 2, section 1.1.3 shows trends at the SRS perimeter for averaged ambient beta/gamma values for DOE-SR (WSRC 2007) and ESOP. ESOP averaged ambient beta/gamma values for 1999 and 2000 represent three quarters of data while all others represent four quarters.

Tritium

Tritium in air values reported by ESOP are the result of using the historical means of calculating an air concentration of tritium based on a generic absolute humidity of 11.5 grams of atmospheric moisture per cubic meter. Section 1.1.4 includes ESOP atmospheric moisture data

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analyzed in 2006. Averaged ESOP air tritium activity was consistently lower than the DOE-SR measured activity although well within the same order-of-magnitude.

Tritium continues to be the predominant radionuclide detected above background in the perimeter samples. During 2006, DOE-SR released approximately 34,600 Ci of tritium from SRS. Most of tritium detected in the ESOP perimeter samples can be attributed to the release of tritium from reactor stacks, separation areas, and from diffuse and fugitive sources (WSRC 2007).

Average atmospheric tritium activity at the SRS perimeter reported by SCDHEC for 2005 was slightly lower than for 2006. Figure 3, section 1.1.3, illustrates trending of atmospheric tritium activity for ESOP and DOE-SR as measured and calculated at the SRS perimeter.

The DOE-SR average measured value for tritium activity in air at the SRS boundary was 7 pCi/$m^3$ (WSRC 2007). The DOE-SR calculated value for tritium activity at the SRS boundary was also 7 pCi/$m^3$ (WSRC 2005). The ESOP average measured activity for tritium was 5 ± 1 pCi/$m^3$. The ESOP average for tritium activity was well below the EPA standards of 20,000 pCi/L in rainwater and 1,500 pCi/$m^3$ for airborne tritium activity. DOE-SR average measured values for tritium in atmospheric moisture were higher than ESOP averaged measured values for the SRS perimeter (WSRC 2007). The ESOP average measured activity for tritium was within two standard deviations of the DOE-SR average of 7 pCi/$m^3$. This may be attributed to a dilution that occurs when desiccants are used for collecting atmospheric moisture for tritium analysis. In a recent study, tritium concentrations in air, as determined using desiccants, can result in under-reporting of air tritium concentrations by factors of 1.4 to 2.6 (Rosson, et al, 2000). Prior to deployment in the field, silica-gel desiccant is dried to remove any moisture. However, a small percentage of water remains in the desiccant. This results in a slight dilution of the collected sample, that is reflected in the distillate. DOE-SR has implemented a correction factor for tritium-in-air measurements using silica-gel (WSRC 2007). DOE-SR also has an airstation located in D-Area, which is in close proximity to tritium facilities. This could explain why the 2006 DOE-SR average measured activity is higher than ESOP average reported measured activity. Another factor that may contribute to the lower ESOP air tritium values is that only two of the monitoring stations are exactly on the SRS perimeter (property line), while the other three points used for this comparison are located approximately two miles from the SRS property line.

The majority of the analytical results for tritium in rainwater were below the LLD at the perimeter. The maximum reported value, 439 ± 98 pCi/L from the Jackson, SC air monitoring station, was collected on February 28, 2006. Section 1.1.4 includes rainwater tritium data for all monitoring locations.

**Summary Statistics**

The average gross alpha activity reported by ESOP at the site perimeters was 0.003 ± 0.001 pCi/$m^3$. The average gross beta activity reported by ESOP at the site perimeter was 0.024 ± 0.002 pCi/$m^3$. The average gross alpha and beta activity reported by DOE-SR at the SRS boundary was 0.001 pCi/$m^3$ and 0.016 pCi/$m^3$ respectively. Average atmospheric tritium activity at the SRS perimeter reported by SCDHEC was 5 ± 1 pCi/$m^3$. The DOE-SR average measured

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value for tritium activity in air at the SRS boundary was 7 pCi/$m^3$. Summary statistics can be found in Section 1.1.5.

**CONCLUSIONS AND RECOMMENDATIONS**

All ESOP data collected confirmed historically reported DOE-SR values for radionuclides in the ambient environment at the SRS boundary with no anomalous data noted for any monitored parameters.

ESOP air and precipitation tritium data were consistently lower than the DOE-SR measured values. Due to the variability of environmental data and the frequency of collecting samples ESOP air and tritium data averages were within four standard deviations of DOE-SR measured averages. Four standard deviations are within an acceptable range when comparing environmental data.

No EPA air standards were exceeded at the monitored locations and there were no elevations of radiological pollutant concentrations associated with SRS operations. Sampling results by ESOP indicate that SRS activities did have a measurable impact on local air quality.

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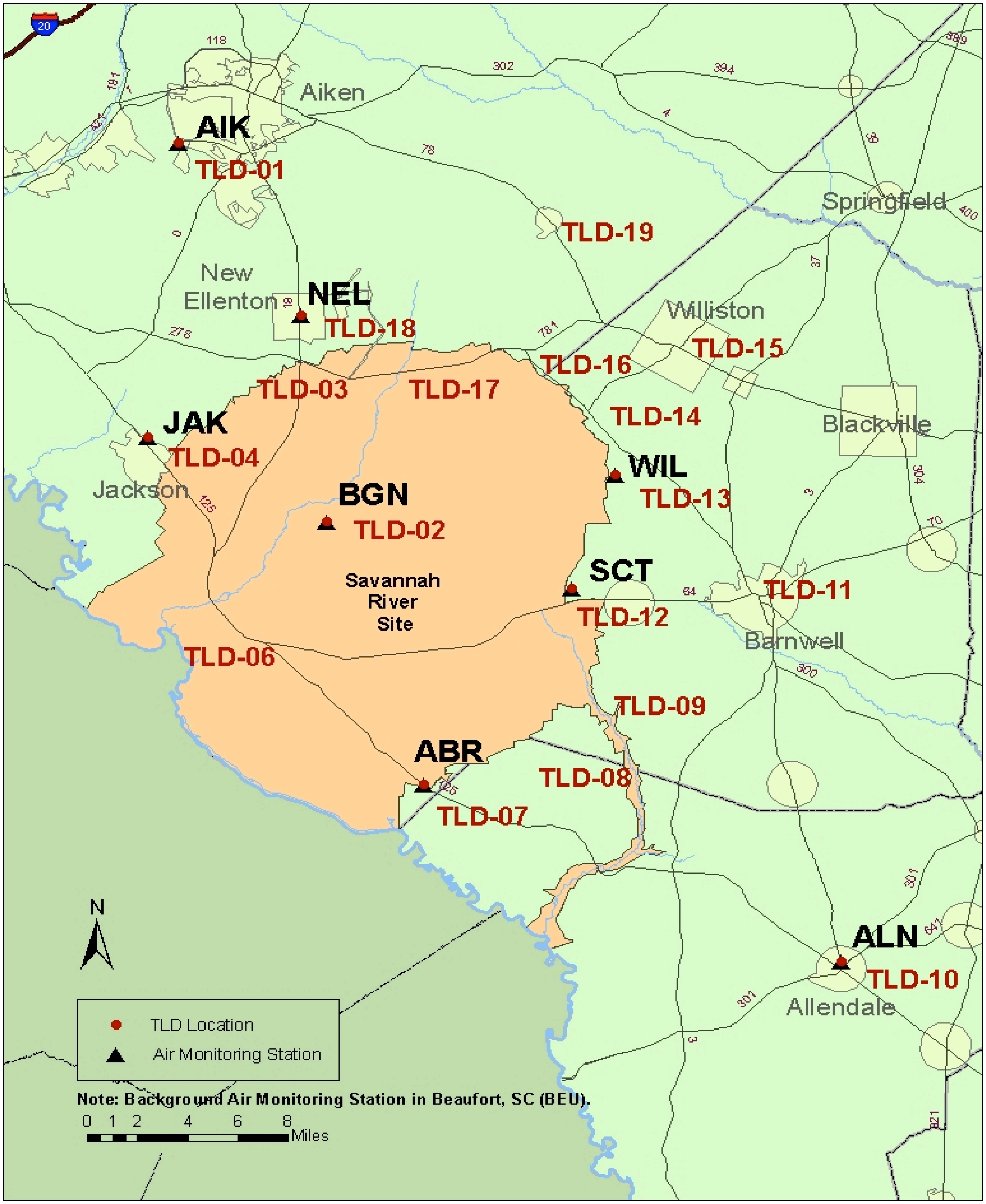
## 1.1.2
## Map 2. Radiological Monitoring of Air Locations

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### 1.1.3 Tables and Figures
### Atmospheric Radiological Monitoring

**Figure 1 Average Gross Beta for TSP at the SRS Perimeter**

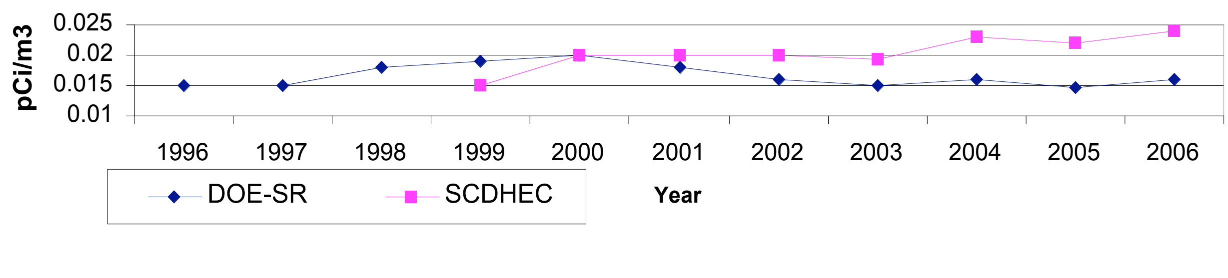



**Figure 2 Average Ambient Beta/Gamma at the SRS Perimeter**

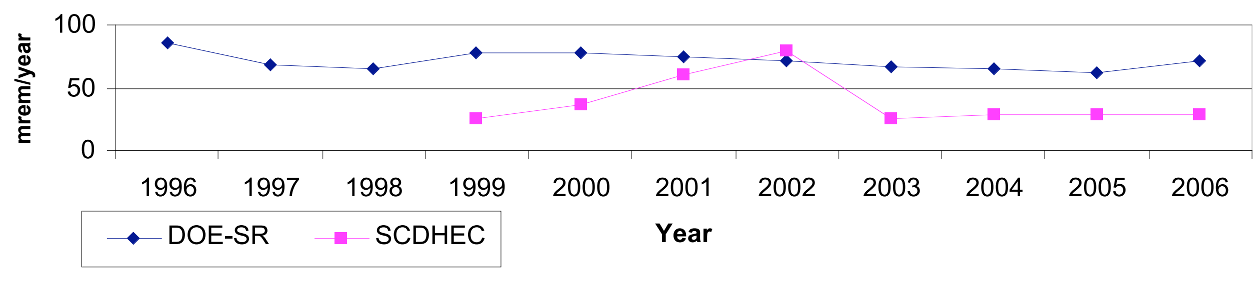
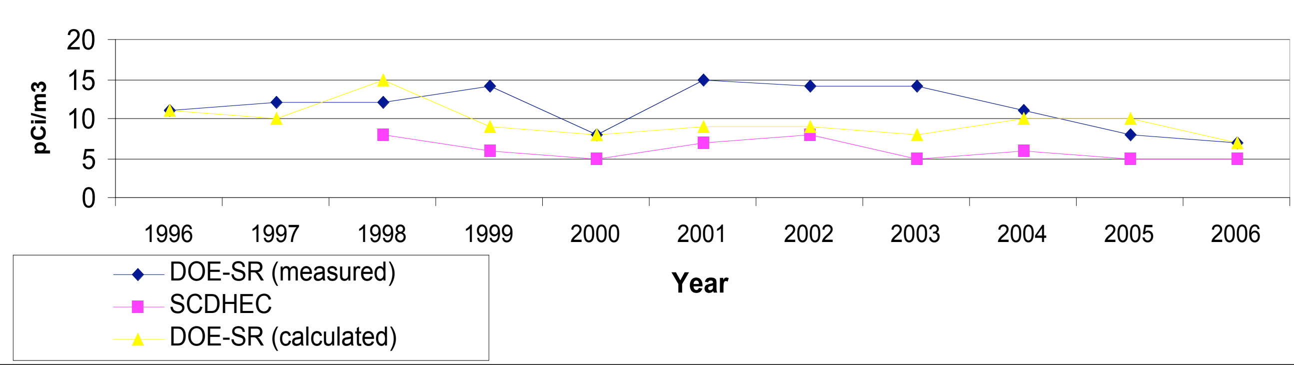



**Figure 3 Average Atmospheric Tritium at the SRS Perimeter**

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### 1.1.4 Data
**Atmospheric Radiological Monitoring**



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## Atmospheric Radiological Monitoring
## Routine Atmospheric Monitoring Data

Sample Location: Aiken Elementary Water Tower (AIK)

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.004 | 0.001 | 0.035 | 0.002 | | | | |
| 1/11/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 1/18/2006 | NS | NA | NS | NA | | | | |
| 1/25/2006 | 0.001 | 0.001 | 0.013 | 0.001 | 4.2 | 1.0 | <173 | |
| 1/31/2006 | 0.002 | 0.001 | 0.016 | 0.002 | | | | |
| 2/8/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 2/16/2006 | 0.004 | 0.001 | 0.020 | 0.002 | | | | |
| 2/22/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 2/28/2006 | 0.003 | 0.001 | 0.022 | 0.002 | 7.2 | 1.2 | <191 | |
| 3/14/2006 | 0.003 | 0.001 | 0.019 | 0.001 | | | | |
| 3/20/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 3/28/2006 | 0.002 | 0.001 | 0.016 | 0.002 | 7.5 | 1.3 | <197 | |
| 4/4/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 4/18/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 4/25/2006 | 0.003 | 0.001 | 0.022 | 0.002 | <2.0 | | <182 | |
| 5/1/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 5/9/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 5/16/2006 | 0.002 | 0.001 | 0.016 | 0.002 | | | | |
| 5/23/2006 | 0.003 | 0.001 | 0.024 | 0.002 | 3.5 | 1.0 | <181 | |
| 5/30/2006 | 0.004 | 0.001 | 0.032 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 6/13/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 6/27/2006 | 0.003 | 0.001 | 0.019 | 0.002 | 3.9 | 1.0 | <183 | |
| 7/3/2006 | 0.003 | 0.001 | 0.034 | 0.002 | | | | |
| 7/11/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 7/18/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 7/26/2006 | 0.003 | 0.001 | 0.027 | 0.002 | 5.1 | 1.1 | <184 | |
| 8/1/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 8/8/2006 | 0.003 | 0.001 | 0.031 | 0.002 | | | | |
| 8/15/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 8/22/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 8/29/2006 | 0.004 | 0.001 | 0.025 | 0.002 | 4.4 | 1.0 | <184 | |
| 9/6/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 9/13/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 9/19/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 9/26/2006 | 0.005 | 0.001 | 0.027 | 0.002 | <2.1 | | <191 | |
| 10/3/2006 | 0.005 | 0.001 | 0.034 | 0.002 | | | | |
| 10/10/2006 | 0.004 | 0.001 | 0.025 | 0.002 | | | | |
| 10/17/2006 | 0.004 | 0.001 | 0.031 | 0.002 | | | | |
| 10/24/2006 | 0.003 | 0.001 | 0.029 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.027 | 0.002 | 4.8 | 1.1 | 198 | 85 |
| 11/7/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 11/14/2006 | 0.002 | 0.001 | 0.026 | 0.002 | | | | |
| 11/21/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.019 | 0.002 | <2.2 | | <197 | |
| 12/5/2006 | 0.004 | 0.001 | 0.027 | 0.002 | | | | |
| 12/12/2006 | 0.022 | 0.001 | 0.024 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.024 | 0.002 | 3.2 | 1.0 | <189 | |

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## Atmospheric Radiological Monitoring
## Routine Atmospheric Monitoring Data

**Sample Location:** New Ellenton, SC (NEL)

| Date | Gross Alpha in Air pCi/m³ | Gross Alpha +- 2 sigma | Gross Beta in Air pCi/m³ | Gross Beta +- 2 sigma | Tritium in Air pCi/m³ | Tritium in Air +- 2 sigma | Tritium in Rain pCi/L | Tritium in Rain +- 2 sigma |
|---|---|---|---|---|---|---|---|---|
| 1/5/2006 | 0.004 | 0.001 | 0.034 | 0.002 | | | | |
| 1/11/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 1/18/2006 | <0.000965 | NA | 0.015 | 0.002 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.016 | 0.002 | 5.3 | 1.0 | 241 | 84 |
| 1/31/2006 | 0.003 | 0.001 | 0.018 | 0.002 | | | | |
| 2/8/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 2/16/2006 | 0.002 | 0.0005 | 0.019 | 0.001 | | | | |
| 2/28/2006 | 0.003 | 0.001 | 0.023 | 0.002 | 4.7 | 1.1 | <191 | |
| 3/14/2006 | 0.002 | 0.0005 | 0.019 | 0.001 | | | | |
| 3/20/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 3/28/2006 | 0.002 | 0.001 | 0.015 | 0.004 | 4.9 | 1.2 | <197 | |
| 4/4/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 4/11/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 4/18/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.025 | 0.002 | 5.0 | 1.1 | 210 | 86 |
| 5/1/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 5/9/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 5/9/2005 | 0.002 | 0.001 | 0.031 | 0.002 | | | | |
| 5/16/2006 | 0.001 | 0.001 | 0.019 | 0.002 | | | | |
| 5/23/2006 | 0.004 | 0.001 | 0.027 | 0.002 | 3.4 | 1.0 | <181 | |
| 5/30/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 6/13/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 6/27/2006 | 0.003 | 0.001 | 0.017 | 0.002 | 4.5 | 1.0 | 235 | 85 |
| 7/3/2006 | 0.002 | 0.001 | 0.032 | 0.002 | | | | |
| 7/11/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 7/18/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 7/26/2006 | 0.003 | 0.001 | 0.022 | 0.002 | 3.1 | 1.0 | <184 | |
| 8/1/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 8/8/2006 | 0.004 | 0.001 | 0.029 | 0.002 | | | | |
| 8/15/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 8/22/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 8/29/2006 | 0.004 | 0.001 | 0.025 | 0.002 | 3.3 | 1.0 | <184 | |
| 9/6/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 9/13/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 9/19/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 9/26/2006 | 0.005 | 0.001 | 0.033 | 0.002 | <2.1 | | <191 | |
| 10/3/2006 | 0.006 | 0.001 | 0.039 | 0.002 | | | | |
| 10/10/2006 | NS | NA | NS | NA | | | | |
| 10/17/2006 | 0.005 | 0.001 | 0.036 | 0.002 | | | | |
| 10/24/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.033 | 0.002 | 5.3 | 1.1 | 224 | 91 |
| 11/7/2006 | 0.004 | 0.001 | 0.029 | 0.002 | | | | |
| 11/14/2006 | 0.035 | 0.001 | 0.002 | 0.002 | | | | |
| 11/21/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.020 | 0.002 | <2.1 | | <197 | |
| 12/5/2006 | 0.004 | 0.001 | 0.026 | 0.002 | | | | |
| 12/12/2006 | 0.036 | 0.001 | 0.035 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.041 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.023 | 0.002 | 4.9 | 1.1 | <189 | |

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# Atmospheric Radiological Monitoring
# Routine Atmospheric Monitoring Data

Sample Location: Jackson, SC (JAK)

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.004 | 0.001 | 0.036 | 0.002 | | | | |
| 1/11/2006 | 0.001 | 0.001 | 0.021 | 0.002 | | | | |
| 1/18/2006 | <0.000991 | NA | 0.017 | 0.002 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.018 | 0.002 | 4.7 | 1.0 | 216 | 83 |
| 1/31/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 2/8/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 2/16/2006 | 0.005 | 0.001 | 0.028 | 0.002 | | | | |
| 2/28/2006 | 0.004 | 0.001 | 0.023 | 0.002 | 9.5 | 1.2 | 439 | 98 |
| 2/28/2006 | 0.004 | 0.001 | 0.025 | 0.002 | | | | |
| 3/14/2006 | 0.002 | 0.001 | 0.020 | 0.001 | | | | |
| 3/20/2006 | 0.005 | 0.001 | 0.031 | 0.002 | | | | |
| 3/28/2006 | 0.002 | 0.001 | 0.015 | 0.001 | 8.4 | 1.2 | 283 | 94 |
| 4/4/2006 | 0.003 | 0.001 | 0.030 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 4/18/2006 | 0.002 | 0.001 | 0.028 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.027 | 0.002 | 3.4 | 1.0 | <182 | |
| 5/1/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 5/9/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 5/16/2006 | <0.001 | NA | 0.018 | 0.002 | | | | |
| 5/23/2006 | 0.002 | 0.001 | 0.027 | 0.002 | 3.1 | 1.0 | <181 | |
| 5/30/2006 | 0.004 | 0.001 | 0.032 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 6/13/2006 | 0.003 | 0.001 | 0.027 | 0.002 | | | | |
| 6/20/2006 | 0.001 | 0.001 | 0.019 | 0.002 | | | | |
| 6/27/2006 | 0.003 | 0.001 | 0.020 | 0.002 | 4.0 | 1.0 | 235 | 87 |
| 7/3/2006 | 0.003 | 0.001 | 0.032 | 0.003 | | | | |
| 7/11/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 7/18/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 7/26/2006 | 0.002 | 0.001 | 0.002 | 0.002 | 3.4 | 1.0 | <184 | |
| 8/1/2006 | 0.002 | 0.001 | 0.002 | 0.002 | | | | |
| 8/8/2006 | 0.002 | 0.001 | 0.034 | 0.002 | | | | |
| 8/15/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 8/22/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 8/29/2006 | 0.003 | 0.001 | 0.027 | 0.002 | 3.7 | 1.0 | 254 | 85 |
| 9/6/2006 | 0.003 | 0.001 | 0.018 | 0.002 | | | | |
| 9/13/2006 | 0.004 | 0.001 | 0.031 | 0.002 | | | | |
| 9/19/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 9/26/2006 | 0.003 | 0.001 | 0.019 | 0.002 | <2.1 | | <191 | |
| 10/3/2006 | 0.004 | 0.001 | 0.024 | 0.002 | | | | |
| 10/10/2006 | 0.003 | 0.001 | 0.017 | 0.002 | | | | |
| 10/17/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 10/24/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.030 | 0.002 | 4.5 | 1.0 | 260 | 92 |
| 11/7/2006 | 0.003 | 0.001 | 0.030 | 0.002 | | | | |
| 11/14/2006 | 0.004 | 0.001 | 0.028 | 0.002 | | | | |
| 11/21/2006 | 0.001 | 0.001 | 0.025 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.023 | 0.002 | 2.7 | 1.0 | <197 | |
| 12/5/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 12/12/2006 | 0.005 | 0.001 | 0.032 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.039 | 0.002 | | | | |
| 12/27/2006 | 0.003 | 0.001 | 0.022 | 0.002 | 3.6 | 1.0 | <189 | |

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# Atmospheric Radiological Monitoring
# Routine Atmospheric Monitoring Data

Sample Location: Burial Grounds North (BGN)

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.003 | 0.001 | 0.035 | 0.002 | | | | |
| 1/11/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 1/18/2006 | 0.001 | 0.001 | 0.017 | 0.002 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.018 | 0.002 | 173.0 | 3.9 | 1965 | 141 |
| 1/31/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 2/8/2006 | 0.003 | 0.001 | 0.027 | 0.002 | | | | |
| 2/16/2006 | 0.004 | 0.001 | 0.025 | 0.002 | | | | |
| 2/22/2006 | 0.004 | 0.001 | 0.024 | 0.002 | | | | |
| 2/28/2006 | 0.003 | 0.001 | 0.023 | 0.002 | 97.5 | 3.0 | 2468 | 158 |
| 3/14/2006 | 0.003 | 0.001 | 0.021 | 0.001 | | | | |
| 3/20/2006 | 0.005 | 0.001 | 0.029 | 0.002 | | | | |
| 3/28/2006 | 0.001 | 0.001 | 0.015 | 0.001 | 95.2 | 3.0 | 2417 | 158 |
| 4/4/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 4/18/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.020 | 0.002 | 166.9 | 3.9 | 1761 | 138 |
| 5/1/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 5/9/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 5/16/2006 | 0.002 | 0.001 | 0.015 | 0.002 | | | | |
| 5/23/2006 | 0.003 | 0.001 | 0.024 | 0.002 | 170.4 | 3.9 | 1647 | 135 |
| 5/30/2006 | 0.003 | 0.001 | 0.028 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 6/13/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 6/27/2006 | 0.001 | 0.001 | 0.016 | 0.002 | 166.5 | 3.9 | 1710 | 136 |
| 7/3/2006 | 0.003 | 0.001 | 0.029 | 0.002 | | | | |
| 7/11/2006 | 0.001 | 0.001 | 0.020 | 0.002 | | | | |
| 7/18/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 7/26/2006 | 0.002 | 0.001 | 0.022 | 0.002 | 166.0 | 3.9 | 1803 | 139 |
| 8/1/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 8/8/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 8/15/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 8/22/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 8/29/2006 | 0.003 | 0.001 | 0.021 | 0.002 | 171.2 | 4.0 | 1956 | 137 |
| 9/6/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 9/13/2006 | 0.004 | 0.001 | 0.034 | 0.002 | | | | |
| 9/19/2005 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 9/26/2006 | 0.007 | 0.001 | 0.024 | 0.002 | 156.7 | 3.6 | 2640 | 152 |
| 10/3/2006 | 0.004 | 0.001 | 0.026 | 0.002 | | | | |
| 10/10/2006 | 0.004 | 0.001 | 0.022 | 0.002 | | | | |
| 10/17/2006 | 0.004 | 0.001 | 0.029 | 0.002 | | | | |
| 10/24/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 10/31/2006 | 0.003 | 0.001 | 0.031 | 0.002 | 165.8 | 3.8 | 1151 | 135 |
| 11/7/2006 | 0.004 | 0.001 | 0.028 | 0.002 | | | | |
| 11/14/2006 | 0.003 | 0.001 | 0.019 | 0.002 | | | | |
| 11/21/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.023 | 0.002 | 171.6 | 3.9 | 3338 | 179 |
| 12/5/2006 | 0.006 | 0.001 | 0.063 | 0.003 | | | | |
| 12/12/2006 | 0.003 | 0.001 | 0.031 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.036 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.022 | 0.002 | 202.5 | 3.9 | 3128 | 176 |

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## Atmospheric Radiological Monitoring
## Routine Atmospheric Monitoring Data

**Sample Location:** **Allendale Barricade (ABR)**

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.003 | 0.001 | 0.029 | 0.002 | | | | |
| 1/11/2006 | <0.001 | NA | 0.016 | 0.002 | | | | |
| 1/18/2006 | 0.001 | 0.001 | 0.016 | 0.002 | | | | |
| 1/25/2006 | 0.001 | 0.001 | 0.014 | 0.001 | 2.5 | 1.0 | <173 | |
| 1/31/2006 | 0.003 | 0.001 | 0.016 | 0.002 | | | | |
| 2/8/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 2/16/2006 | 0.003 | 0.001 | 0.018 | 0.001 | | | | |
| 2/22/2006 | 0.003 | 0.001 | 0.015 | 0.002 | | | | |
| 2/28/2006 | 0.003 | 0.001 | 0.020 | 0.002 | 4.2 | 1.1 | <191 | |
| 3/14/2006 | 0.002 | 0.0004 | 0.013 | 0.001 | | | | |
| 3/20/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 3/28/2006 | 0.001 | 0.001 | 0.012 | 0.001 | 3.9 | 1.1 | <197 | |
| 4/4/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 4/18/2006 | 0.001 | 0.001 | 0.020 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.021 | 0.002 | 2.4 | 1.0 | <182 | |
| 5/1/2006 | 0.001 | 0.001 | 0.019 | 0.002 | | | | |
| 5/9/2006 | <0.001 | NA | 0.004 | 0.001 | | | | |
| 5/16/2006 | <0.001 | NA | 0.015 | 0.002 | | | | |
| 5/23/2006 | 0.002 | 0.001 | 0.023 | 0.002 | <2.0 | | <181 | |
| 5/30/2006 | 0.002 | 0.001 | 0.016 | 0.002 | | | | |
| 6/6/2006 | 0.001 | 0.001 | 0.012 | 0.002 | | | | |
| 6/13/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 6/27/2006 | <.0014 | NA | 0.015 | 0.002 | <2.1 | | <183 | |
| 7/3/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 7/11/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 7/18/2006 | 0.002 | 0.001 | 0.016 | 0.002 | | | | |
| 7/26/2006 | <.000934 | NA | 0.005 | 0.001 | <2.1 | | <184 | |
| 8/1/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 8/8/2006 | 0.002 | 0.001 | 0.026 | 0.002 | | | | |
| 8/15/2006 | 0.001 | 0.001 | 0.008 | 0.001 | | | | |
| 8/22/2006 | 0.002 | 0.001 | 0.017 | 0.002 | | | | |
| 8/29/2006 | 0.003 | 0.001 | 0.019 | 0.002 | 2.6 | 1.0 | <184 | |
| 9/6/2006 | 0.002 | 0.001 | 0.017 | 0.002 | | | | |
| 9/13/2006 | 0.004 | 0.001 | 0.036 | 0.002 | | | | |
| 9/19/2005 | 0.002 | 0.001 | 0.026 | 0.002 | | | | |
| 9/26/2006 | 0.003 | 0.001 | 0.024 | 0.002 | <2.1 | | <191 | |
| 10/3/2006 | 0.005 | 0.001 | 0.026 | 0.002 | | | | |
| 10/10/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 10/17/2006 | 0.004 | 0.001 | 0.034 | 0.002 | | | | |
| 10/24/2006 | 0.004 | 0.001 | 0.028 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.027 | 0.002 | 4.9 | 1.1 | 200 | 91 |
| 11/7/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 11/14/2006 | 0.004 | 0.001 | 0.025 | 0.002 | | | | |
| 11/21/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.018 | 0.002 | 5.3 | 1.1 | <197 | |
| 12/5/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 12/12/2006 | 0.005 | 0.001 | 0.032 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.037 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.022 | 0.002 | 4.7 | 1.1 | <189 | |

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# Atmospheric Radiological Monitoring
# Routine Atmospheric Monitoring Data

Sample Location: Allendale, SC (ALN)

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.004 | 0.001 | 0.038 | 0.002 | | | | |
| 1/11/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 1/18/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.020 | 0.002 | <173 | | <173 | |
| 1/31/2006 | 0.003 | 0.001 | 0.018 | 0.002 | | | | |
| 2/8/2006 | 0.003 | 0.001 | 0.027 | 0.002 | | | | |
| 2/16/2006 | 0.005 | 0.001 | 0.027 | 0.002 | | | | |
| 2/22/2006 | 0.005 | 0.001 | 0.024 | 0.002 | | | | |
| 2/28/2006 | 0.004 | 0.001 | 0.025 | 0.002 | <191 | | <191 | |
| 3/14/2006 | 0.003 | 0.001 | 0.020 | 0.001 | | | | |
| 3/20/2006 | 0.005 | 0.001 | 0.027 | 0.002 | | | | |
| 3/28/2006 | 0.002 | 0.001 | 0.015 | 0.001 | <197 | | <197 | |
| 4/4/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 4/18/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.025 | 0.002 | <182 | | <182 | |
| 5/1/2006 | <LLD | | 0.023 | 0.002 | | | | |
| 5/9/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 5/16/2006 | 0.001 | 0.001 | 0.015 | 0.002 | | | | |
| 5/23/2006 | 0.003 | 0.001 | 0.025 | 0.002 | <181 | | <181 | |
| 5/30/2006 | 0.003 | 0.001 | 0.032 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 6/13/2006 | 0.004 | 0.001 | 0.029 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 6/27/2006 | 0.001 | 0.001 | 0.016 | 0.002 | <183 | | <183 | |
| 7/3/2006 | 0.003 | 0.001 | 0.028 | 0.002 | | | | |
| 7/11/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 7/18/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 7/26/2006 | 0.002 | 0.001 | 0.022 | 0.002 | <184 | | <184 | |
| 8/1/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 8/8/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 8/15/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 8/22/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 8/29/2006 | 0.003 | 0.001 | 0.019 | 0.002 | <184 | | <184 | |
| 9/6/2006 | 0.002 | 0.001 | 0.015 | 0.002 | | | | |
| 9/13/2006 | 0.004 | 0.001 | 0.036 | 0.002 | | | | |
| 9/19/2006 | 0.002 | 0.001 | 0.028 | 0.002 | | | | |
| 9/26/2006 | 0.004 | 0.001 | 0.023 | 0.002 | <191 | | <191 | |
| 10/3/2006 | 0.003 | 0.001 | 0.020 | 0.002 | | | | |
| 10/10/2006 | 0.002 | 0.001 | 0.013 | 0.002 | | | | |
| 10/17/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 10/24/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.032 | 0.002 | <196 | | <196 | |
| 11/7/2006 | 0.001 | 0.001 | 0.009 | 0.001 | | | | |
| 11/14/2006 | 0.004 | 0.001 | 0.021 | 0.001 | | | | |
| 11/21/2006 | 0.002 | 0.001 | 0.026 | 0.002 | | | | |
| 11/28/2006 | 0.002 | 0.001 | 0.020 | 0.002 | <197 | | <197 | |
| 12/5/2006 | 0.003 | 0.001 | 0.027 | 0.002 | | | | |
| 12/12/2006 | 0.005 | 0.001 | 0.032 | 0.002 | | | | |
| 12/19/2006 | 0.003 | 0.001 | 0.039 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.023 | 0.002 | <189 | | <189 | |

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# Atmospheric Radiological Monitoring
# Routine Atmospheric Monitoring Data

**Sample Location:** **Snelling, SC (SCT)**

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | $pCi/m^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.004 | 0.001 | 0.036 | 0.002 | | | | |
| 1/11/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 1/18/2006 | <0.00101 | NA | 0.019 | 0.001 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.018 | 0.002 | 4.9 | 1.0 | 211 | 82 |
| 1/31/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 2/8/2006 | 0.002 | 0.007 | 0.024 | 0.002 | | | | |
| 2/16/2006 | 0.005 | 0.001 | 0.027 | 0.002 | | | | |
| 2/22/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 2/28/2006 | 0.003 | 0.001 | 0.025 | 0.002 | 5.8 | 1.1 | <191 | |
| 3/14/2006 | 0.002 | 0.0005 | 0.018 | 0.001 | | | | |
| 3/20/2006 | 0.005 | 0.001 | 0.032 | 0.002 | | | | |
| 3/28/2006 | 0.001 | 0.001 | 0.012 | 0.001 | 7.6 | 1.2 | <197 | |
| 4/4/2006 | NS | NA | NS | NA | | | | |
| 4/11/2006 | NS | NA | NS | NA | | | | |
| 4/18/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 4/25/2006 | 0.003 | 0.001 | 0.025 | 0.002 | 4.7 | 1.0 | <182 | |
| 5/1/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 5/9/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 5/16/2006 | 0.001 | 0.001 | 0.018 | 0.002 | | | | |
| 5/23/2006 | 0.003 | 0.001 | 0.028 | 0.002 | 2.2 | 1.0 | <181 | |
| 5/30/2006 | 0.004 | 0.001 | 0.035 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 6/13/2006 | 0.004 | 0.001 | 0.026 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 6/27/2006 | 0.002 | 0.001 | 0.018 | 0.002 | 3.5 | 1.0 | <183 | |
| 7/3/2006 | 0.003 | 0.001 | 0.030 | 0.002 | | | | |
| 7/11/2006 | 0.001 | 0.001 | 0.021 | 0.002 | | | | |
| 7/18/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 7/26/2006 | 0.002 | 0.001 | 0.024 | 0.002 | 3.8 | 1.0 | <184 | |
| 8/1/2006 | 0.002 | 0.001 | 0.027 | 0.002 | | | | |
| 8/8/2006 | 0.003 | 0.001 | 0.028 | 0.002 | | | | |
| 8/15/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 8/22/2006 | NS | NA | NS | NA | | | | |
| 8/29/2006 | 0.003 | 0.001 | 0.024 | 0.002 | 4.0 | 1.0 | <184 | |
| 9/6/2006 | 0.003 | 0.001 | 0.021 | 0.002 | | | | |
| 9/13/2006 | 0.004 | 0.001 | 0.032 | 0.002 | | | | |
| 9/19/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 9/26/2006 | 0.004 | 0.001 | 0.028 | 0.002 | 4.9 | 1.1 | <191 | |
| 10/3/2006 | 0.005 | 0.001 | 0.035 | 0.002 | | | | |
| 10/10/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 10/17/2006 | 0.005 | 0.001 | 0.036 | 0.002 | | | | |
| 10/24/2006 | 0.003 | 0.001 | 0.027 | 0.002 | | | | |
| 10/31/2006 | 0.003 | 0.001 | 0.030 | 0.002 | 4.4 | 1.0 | 380 | 98 |
| 11/7/2006 | 0.003 | 0.001 | 0.028 | 0.002 | | | | |
| 11/14/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 11/21/2006 | 0.001 | 0.001 | 0.023 | 0.002 | | | | |
| 11/28/2006 | 0.003 | 0.001 | 0.020 | 0.002 | <2.2 | | <197 | |
| 12/5/2006 | 0.003 | 0.001 | 0.025 | 0.002 | | | | |
| 12/12/2006 | 0.004 | 0.001 | 0.032 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.039 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.025 | 0.002 | 7.0 | 1.1 | <189 | |

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## Atmospheric Radiological Monitoring
## Routine Atmospheric Monitoring Data

**Sample Location:** **Williston, SC (WIL)**

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | pCi/m$^3$ | +- 2 sigma | pCi/m$^3$ | +- 2 sigma | pCi/m$^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 1/5/2006 | 0.003 | 0.001 | 0.031 | 0.002 | | | | |
| 1/11/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 1/18/2006 | <0.000964 | NA | 0.015 | 0.001 | | | | |
| 1/25/2006 | 0.002 | 0.001 | 0.017 | 0.002 | 4.0 | 1.0 | <173 | |
| 1/31/2006 | 0.003 | 0.001 | 0.017 | 0.002 | | | | |
| 2/8/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 2/16/2006 | 0.004 | 0.001 | 0.024 | 0.002 | | | | |
| 2/22/2006 | 0.003 | 0.001 | 0.022 | 0.002 | | | | |
| 2/28/2006 | 0.004 | 0.001 | 0.025 | 0.002 | 7.8 | 1.2 | <191 | |
| 3/14/2006 | 0.003 | 0.0005 | 0.017 | 0.001 | | | | |
| 3/20/2006 | 0.004 | 0.001 | 0.027 | 0.002 | | | | |
| 3/28/2006 | 0.003 | 0.001 | 0.019 | 0.002 | 7.1 | 1.1 | <197 | |
| 4/4/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 4/11/2006 | 0.002 | 0.001 | 0.023 | 0.002 | | | | |
| 4/18/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 4/25/2006 | 0.002 | 0.001 | 0.025 | 0.002 | 4.5 | 1.0 | <182 | |
| 5/1/2006 | <LLD | | 0.035 | 0.007 | | | | |
| 5/9/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 5/16/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 5/23/2006 | 0.002 | 0.001 | 0.025 | 0.002 | 2.9 | 1.0 | <181 | |
| 5/30/2006 | 0.003 | 0.001 | 0.029 | 0.002 | | | | |
| 6/6/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 6/13/2006 | 0.004 | 0.001 | 0.025 | 0.002 | | | | |
| 6/20/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 6/27/2006 | 0.002 | 0.001 | 0.015 | 0.002 | 4.7 | 1.0 | 214 | 86 |
| 7/3/2006 | 0.003 | 0.001 | 0.035 | 0.003 | | | | |
| 7/11/2006 | 0.002 | 0.001 | 0.022 | 0.002 | | | | |
| 7/18/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 7/26/2006 | 0.002 | 0.001 | 0.023 | 0.002 | 5.1 | 1.0 | 231 | 84 |
| 8/1/2006 | 0.002 | 0.001 | 0.024 | 0.002 | | | | |
| 8/8/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 8/15/2006 | 0.002 | 0.001 | 0.018 | 0.002 | | | | |
| 8/22/2006 | 0.002 | 0.001 | 0.021 | 0.002 | | | | |
| 8/29/2006 | 0.004 | 0.001 | 0.021 | 0.002 | 6.0 | 1.0 | 293 | 87 |
| 9/6/2006 | 0.002 | 0.001 | 0.019 | 0.002 | | | | |
| 9/13/2006 | 0.003 | 0.001 | 0.030 | 0.002 | | | | |
| 9/19/2006 | 0.003 | 0.001 | 0.023 | 0.002 | | | | |
| 9/26/2006 | 0.003 | 0.001 | 0.024 | 0.002 | 4.1 | 1.0 | <191 | |
| 10/3/2006 | 0.004 | 0.001 | 0.031 | 0.002 | | | | |
| 10/10/2006 | 0.004 | 0.001 | 0.019 | 0.002 | | | | |
| 10/17/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 10/24/2006 | 0.003 | 0.001 | 0.026 | 0.002 | | | | |
| 10/31/2006 | 0.004 | 0.001 | 0.029 | 0.002 | 5.0 | 1.0 | 196 | 88 |
| 11/7/2006 | 0.003 | 0.001 | 0.029 | 0.002 | | | | |
| 11/14/2006 | 0.004 | 0.001 | 0.027 | 0.002 | | | | |
| 11/21/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 11/28/2006 | 0.002 | 0.001 | 0.018 | 0.002 | <2.2 | | <2.2 | |
| 12/5/2006 | 0.003 | 0.001 | 0.024 | 0.002 | | | | |
| 12/12/2006 | 0.004 | 0.001 | 0.030 | 0.002 | | | | |
| 12/19/2006 | 0.004 | 0.001 | 0.035 | 0.002 | | | | |
| 12/27/2006 | 0.002 | 0.001 | 0.022 | 0.002 | 6.0 | 1.0 | <189 | |

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# Atmospheric Radiological Monitoring
# Routine Atmospheric Monitoring Data

**Sample Location:** **Beaufort Air Sation (BEU)**

| Date | Gross Alpha in Air | | Gross Beta in Air | | Tritium in Air | | Tritium in Rain | |
|---|---|---|---|---|---|---|---|---|
| | pCi/m$^3$ | +- 2 sigma | pCi/m$^3$ | +- 2 sigma | pCi/m$^3$ | +- 2 sigma | pCi/L | +- 2 sigma |
| 12/15/2005 | 0.005 | 0.001 | 0.013 | 0.001 | | | | |
| 12/29/2005 | 0.008 | 0.001 | 0.058 | 0.002 | <187 | | <187 | |
| 1/10/2006 | 0.002 | 0.001 | 0.023 | 0.001 | | | | |
| 1/25/2006 | 0.006 | 0.001 | 0.017 | 0.001 | <194 | | <194 | |
| 2/9/2006 | 0.006 | 0.001 | 0.018 | 0.001 | | | | |
| 2/27/2006 | 0.003 | 0.0004 | 0.017 | 0.001 | <189 | | <189 | |
| 3/10/2006 | 0.003 | 0.001 | 0.019 | 0.001 | | | | |
| 3/24/2006 | 0.003 | 0.001 | 0.015 | 0.001 | <201 | | <201 | |
| 4/7/2006 | 0.002 | 0.001 | 0.019 | 0.001 | | | | |
| 4/17/2006 | 0.001 | 0.0002 | 0.014 | 0.001 | <196 | | <196 | |
| 5/3/2006 | 0.003 | 0.001 | 0.019 | 0.002 | | | | |
| 5/21/2006 | 0.003 | 0.001 | 0.026 | 0.002 | <184 | | <184 | |
| 6/8/2006 | 0.002 | 0.0004 | 0.016 | 0.001 | | | | |
| 6/22/2006 | 0.005 | 0.001 | 0.012 | 0.001 | <188 | | <188 | |
| 7/10/2006 | 0.004 | 0.001 | 0.028 | 0.001 | | | | |
| 7/26/2006 | 0.005 | 0.001 | 0.028 | 0.002 | <199 | | <199 | |
| 8/7/2006 | 0.001 | 0.0002 | 0.014 | 0.001 | | | | |
| 8/25/2006 | 0.003 | 0.001 | 0.017 | 0.001 | <182 | | <182 | |
| 9/7/2006 | 0.002 | 0.001 | 0.020 | 0.002 | | | | |
| 9/25/2006 | 0.004 | 0.001 | 0.009 | 0.001 | <196 | | <196 | |
| 10/9/2006 | 0.009 | 0.001 | 0.043 | 0.002 | | | | |
| 10/23/2006 | 0.005 | 0.001 | 0.045 | 0.002 | <184 | | <184 | |
| 11/6/2006 | 0.007 | 0.001 | 0.039 | 0.002 | | | | |
| 11/22/2006 | 0.003 | 0.001 | 0.022 | 0.002 | <191 | | <191 | |
| 12/7/2006 | 0.002 | 0.001 | 0.025 | 0.002 | | | | |
| 12/28/2006 | 0.004 | 0.001 | 0.029 | 0.002 | <202 | | <202 | |

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## Atmospheric Radiological Monitoring
## Quarterly Atmospheric Ambient Beta/Gamma Data

| Sample | Quarter | Quarter | Quarter | Quarter | Year |
|---|---|---|---|---|---|
| | mrem | mrem | mrem | mrem | mrem |
| Co-located with Aiken Air | 21.00 | 20.00 | 25.00 | 24.00 | 90.00 |
| E Area | 33.00 | 31.00 | 37.00 | 38.00 | 139.00 |
| Green | 24.00 | 24.00 | 27.00 | 31.00 | 106.00 |
| Co-located with Jackson Air | 22.00 | 21.00 | 25.00 | 22.00 | 90.00 |
| Crackerneck | 28.00 | 28.00 | 30.00 | 27.00 | 113.00 |
| TNX Boat | 29.00 | 29.00 | 31.00 | 30.00 | 119.00 |
| Co-located with Allendale | 20.00 | 20.00 | 22.00 | 24.00 | 86.00 |
| Junction of Millet Road and Round Tree | 31.00 | 27.00 | 27.00 | 30.00 | 115.00 |
| Patterson Mill road At Lower Three Runs | 26.00 | 31.00 | 30.00 | 31.00 | 118.00 |
| Co-located with Allendale Air | 24.00 | 24.00 | 25.00 | 26.00 | 99.00 |
| Barnwell | 24.00 | 24.00 | 26.00 | 27.00 | 101.00 |
| Co-located with Snelling Air | 27.00 | 24.00 | MS | 28.00 | 79.00 |
| Co-located with Williston Air | 25.00 | 22.00 | 25.00 | 27.00 | 99.00 |
| Bates | 23.00 | 21.00 | 26.00 | 24.00 | 94.00 |
| Williston Police | 28.00 | 24.00 | 29.00 | 30.00 | 111.00 |
| Junction of US 278 and SC | 26.00 | 24.00 | 25.00 | 27.00 | 102.00 |
| US 278 near Upper Three Runs | 31.00 | 32.00 | 32.00 | 34.00 | 129.00 |
| Co-located with New Ellenton Air | 25.00 | 22.00 | 26.00 | 28.00 | 101.00 |
| Windsor Post | 32.00 | 24.00 | 27.00 | 26.00 | 109.00 |

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# Atmospheric Radiological Monitoring Radiochemical Data

Sample Location: **Aiken, SC (AIK)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 6.78E-07 | 6.82E-06 |
| (pCi/m3) | +- 2 sigma | 3.39E-06 | |
| | Pu-239 | 1.35E-06 | 6.14E-06 |
| | +- 2 sigma | 3.38E-06 | |
| | Sr-89/90 | 4.74E-05 | 9.03E-05 |
| | +- 2 sigma | 4.78E-05 | |

Sample Location: **Snelling, SC (SCT)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 1.02E-10 | 6.45E-06 |
| (pCi/m3) | +- 2 sigma | 2.50E-06 | |
| | Pu-239 | 6.26E-06 | 2.37E-06 |
| | +- 2 sigma | 3.10E-06 | |
| | Sr-89/90 | 1.82E-06 | 1.23E-06 |
| | +- 2 sigma | 1.80E-06 | |

Sample Location: **Burial Grounds North (SRS)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 3.25E-07 | 5.16E-06 |
| (pCi/m3) | +- 2 sigma | 2.63E-06 | |
| | Pu-239 | 3.25E-06 | 3.24E-06 |
| | +- 2 sigma | 3.24E-06 | |
| | Sr-89/90 | 3.48E-05 | 8.30E-05 |
| | +- 2 sigma | 4.52E-05 | |

Sample Location: **Allendale Barricade, SC (ABR)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 2.27E-07 | 5.27E-07 |
| (pCi/m3) | +- 2 sigma | 5.50E-07 | |
| | Pu-239 | 6.78E-07 | 6.13E-07 |
| | +- 2 sigma | 7.90E-07 | |
| | Sr-89/90 | 2.74E-07 | 5.13E-06 |
| | +- 2 sigma | 9.50E-07 | |

Sample Location: **New Ellenton, SC (NEL)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 2.33E-06 | 3.16E-06 |
| (pCi/m3) | +- 2 sigma | 3.30E-06 | |
| | Pu-239 | 2.33E-06 | 1.25E-05 |
| | +- 2 sigma | 5.70E-06 | |
| | Sr-89/90 | 1.38E-06 | 1.87E-06 |
| | +- 2 sigma | 2.00E-06 | |

Sample Location: **Allendale, SC (ALN)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 1.86E-06 | 1.33E-06 |
| (pCi/m3) | +- 2 sigma | 1.20E-06 | |
| | Pu-239 | 1.96E-06 | 1.33E-06 |
| | +- 2 sigma | 2.00E-06 | |
| | Sr-89/90 | 1.83E-06 | 1.68E-06 |
| | +- 2 sigma | 1.56E-06 | |

Sample Location: **Williston, SC (WIL)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | 9.84E-07 | 7.24E-06 |
| (pCi/m3) | +- 2 sigma | 3.40E-06 | |
| | Pu-239 | 1.47E-10 | 7.21E-06 |
| | +- 2 sigma | 2.80E-06 | |
| | Sr-89/90 | 2.69E-06 | 2.43E-06 |
| | +- 2 sigma | 3.10E-06 | |

Sample Location: **Jackson, SC (JAK)**

| Sample Batch: | | 1st Quarter 20( | MDC |
|---|---|---|---|
| Radionuclides | Pu-238 | -1.36E-06 | 9.99E-06 |
| (pCi/m3) | +- 2 sigma | 2.70E-06 | |
| | Pu-239 | 4.06E-06 | 3.67E-06 |
| | +- 2 sigma | 4.70E-06 | |
| | Sr-89/90 | 4.27E-06 | 1.65E-06 |
| | +- 2 sigma | 3.30E-06 | |

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## 1.1.5 Summary Statistics
## Radiological Monitoring of Air Data

**Statistical Review Of Radiological Monitoring at Aiken Elementary Water Tower (AIK)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in Rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.024 | 4.9 | <LLD |
| **Std Dev** | 0.003 | 0.005 | 1.5 | <LLD |
| **Median** | 0.003 | 0.024 | 4.4 | <LLD |
| **Min** | 0.001 | 0.013 | 3.2 | <LLD |
| **Max** | 0.022 | 0.035 | 7.5 | <LLD |

**Statistical Review Of Radiological Monitoring at New Ellenton, SC (NEL)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.004 | 0.024 | 4.4 | 228 |
| **Std Dev** | 0.007 | 0.007 | 0.9 | 14 |
| **Median** | 0.003 | 0.024 | 4.8 | 230 |
| **Min** | 0.001 | 0.002 | 3.1 | 210 |
| **Max** | 0.036 | 0.041 | 5.3 | 241 |

**Statistical Review Of Radiological Monitoring at Jackson, SC (JAK)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.024 | 4.6 | 281 |
| **Std Dev** | 0.001 | 0.007 | 2.2 | 81 |
| **Median** | 0.003 | 0.025 | 3.7 | 257 |
| **Min** | 0.001 | 0.002 | 2.7 | 216 |
| **Max** | 0.005 | 0.039 | 9.5 | 439 |

**Statistical Review Of Radiological Monitoring at Allendale Barricade (ABR)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.020 | 3.8 | N/A |
| **Std Dev** | 0.001 | 0.007 | 1.2 | N/A |
| **Median** | 0.002 | 0.020 | 4.1 | 200 |
| **Min** | 0.001 | 0.004 | 2.4 | 200 |
| **Max** | 0.005 | 0.037 | 5.3 | 200 |

**Statistical Review Of Radiological Monitoring at Allendale, SC (ALN)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.023 | <LLD | <LLD |
| **Std Dev** | 0.001 | 0.006 | <LLD | <LLD |
| **Median** | 0.003 | 0.023 | <LLD | <LLD |
| **Min** | 0.001 | 0.009 | <LLD | <LLD |
| **Max** | 0.005 | 0.039 | <LLD | <LLD |

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## Summary Statistics
## Radiological Monitoring of Air Data

**Statistical Review Of Radiological Monitoring at Snelling, SC (SCT)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.025 | 4.8 | 296 |
| **Std Dev** | 0.001 | 0.006 | 1.5 | 120 |
| **Median** | 0.003 | 0.024 | 4.7 | 296 |
| **Min** | 0.001 | 0.012 | 2.2 | 211 |
| **Max** | 0.005 | 0.039 | 7.6 | 380 |

**Statistical Review Of Radiological Monitoring at Williston, SC (WIL)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.024 | 5.2 | 234 |
| **Std Dev** | 0.001 | 0.005 | 1.4 | 42 |
| **Median** | 0.003 | 0.023 | 5.0 | 223 |
| **Min** | 0.0020 | 0.015 | 2.9 | 196 |
| **Max** | 0.004 | 0.035 | 7.8 | 293 |

**Statistical Review of Radiological monitoring at Burial Grounds North, SRS (BGN)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.003 | 0.024 | 159 | 2165 |
| **Std Dev** | 0.001 | 0.007 | 31 | 644 |
| **Median** | 0.003 | 0.022 | 167 | 1961 |
| **Min** | 0.001 | 0.015 | 95 | 1151 |
| **Max** | 0.007 | 0.063 | 203 | 3338 |

**Statistical Review Of Radiological Monitoring at Beaufort, SC (BEU)**

| | Gross Alpha | Gross Beta | Tritium in Air | Tritium in rain |
|---|---|---|---|---|
| **Mean** | 0.004 | 0.023 | <LLD | <LLD |
| **Std Dev** | 0.002 | 0.012 | <LLD | <LLD |
| **Median** | 0.003 | 0.019 | <LLD | <LLD |
| **Min** | 0.001 | 0.009 | <LLD | <LLD |
| **Max** | 0.009 | 0.058 | <LLD | <LLD |

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## Summary Statistics
## Radiological Monitoring of Air Data
## Ambient TLD Beta/Gamma

| Sample | Quarterly | Std | Min | Max | Median |
|---|---|---|---|---|---|
| | mrem | mrem | mrem | mrem | |
| Co-located with Aiken Air | 22.50 | 2.38 | 20.00 | 25.00 | 22.50 |
| E | 34.75 | 3.30 | 31.00 | 38.00 | 34.75 |
| Green | 26.50 | 3.32 | 24.00 | 31.00 | 26.50 |
| Co-located with Jackson Air | 22.50 | 1.73 | 21.00 | 25.00 | 22.00 |
| Crackerneck | 28.25 | 1.26 | 27.00 | 30.00 | 28.00 |
| TNX Boat | 29.75 | 0.96 | 29.00 | 31.00 | 29.50 |
| Co-located with Allendale | 21.50 | 1.91 | 20.00 | 24.00 | 21.00 |
| Junction of Millet Road and Round Tree | 28.75 | 2.06 | 27.00 | 31.00 | 28.50 |
| Patterson Mill road At Lower Three Runs | 29.50 | 2.38 | 26.00 | 31.00 | 30.50 |
| Co-located with Allendale Air | 24.75 | 0.96 | 24.00 | 26.00 | 24.50 |
| Barnwell | 25.25 | 1.50 | 24.00 | 27.00 | 25.00 |
| Co-located with Snelling Air | 26.33 | 2.08 | 24.00 | 28.00 | 27.00 |
| Co-located with Williston Air | 24.75 | 2.06 | 22.00 | 27.00 | 25.00 |
| Bates | 23.50 | 2.08 | 21.00 | 26.00 | 23.50 |
| Williston Police | 27.75 | 2.63 | 24.00 | 30.00 | 28.50 |
| Junction of US 278 and SC | 25.50 | 1.29 | 24.00 | 27.00 | 25.50 |
| US 278 near Upper Three Runs | 32.25 | 1.26 | 21.00 | 34.00 | 32.00 |
| Co-located with New Ellenton Air | 25.25 | 2.50 | 22.00 | 28.00 | 25.50 |
| Windsor Post | 27.25 | 3.40 | 24.00 | 32.00 | 26.50 |

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## 2.1 Ambient Groundwater Monitoring Adjacent to SRS

### 2.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) evaluates ambient groundwater quality adjacent to the Savannah River Site (SRS) to develop offsite water quality information and determine if contaminants have migrated off SRS. The study area includes SRS and a 10-mile perimeter from the SRS boundary in South Carolina. ESOP evaluates five aquifer zones within the study area, from the shallow water table to confined aquifers more than 1400 feet deep. ESOP collects samples from different portions of the network on a five-year cycle. In 2006, ESOP sampled 14 wells from the eastern and northeastern portions of the study area. ESOP analyzed non-filtered groundwater for basic water quality parameters, metals, and tritium in addition to alpha-emitting, beta-emitting, and gamma-emitting radioisotopes.

**RESULTS AND DISCUSSION**

Based on a review of the wet chemistry, metal, tritium, alpha-, beta-, and gamma-emitting radioisotope analytical data, various contaminants were detected in 14 wells sampled. One of the 14 wells contained contaminants (Table 1, section 2.1.3) in excess of the United States Environmental Protection Agency (EPA) "action level" of 0.015 milligrams per liter (mg/L) for lead and Maximum Contaminant Levels (MCL) of 15 picocuries per liter (pCi/L) and 8 pCi/L for gross alpha and gross non-volatile beta respectively.

Because DOE-SR collects groundwater samples from a different monitoring well network, direct comparisons could not be made to their findings in the latest DOE-SR report (WSRC 2007). However, statistical results acquired from ESOP perimeter and background sampling locations tend to support DOE-SR findings that radiological and nonradiological contaminants associated with SRS activities have not migrated off the SRS via the groundwater route. Analytical results are summarized in section 2.1.4.

<u>Metals</u>

The presence of metals in the environment can be attributed to man-made processes and/or the natural decay of deposits. With the exception of lead, a review of the following metal contaminants detected indicates that their presence is most likely due to the erosion of natural deposits. In addition, the position of these wells relative to the hydraulically cross-gradient location of SRS's centrally located process areas supports the theory of natural occurrence.

Barium was detected in wells G06139 (0.078 milligrams per liter (mg/L)), G06109 (0.054 mg/L), M06005 (0.18 mg/L), M06014 (0.21 mg/L), and M06004 (0.061 mg/L). The MCL for barium is 2 mg/L. Calculation of summary statistics revealed a barium average of 0.12 mg/L (+/- 0.07 mg/L).

Chromium was detected at a concentration of 0.084 mg/L in well M06005. The MCL for chromium is 0.100 mg/L.

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Copper was detected at concentrations of 0.019 mg/L, 0.011 mg/L, and 0.071 mg/L in wells G06147, M06005, and D06002 respectively. The MCL for copper is 1.3 mg/L. Calculation of summary statistics revealed a copper average of 0.03 mg/L (+/- 0.03 mg/L).

Lead was detected at concentrations of 0.018 mg/L and 0.013 mg/L in wells M06005 and M06004 respectively. The EPA "action level" for lead is 0.015 mg/L. The lead concentration in these wells is probably due to the corrosion of well construction material or formation chemistry interactions. Well M06005 is only utilized for monitoring purposes and is not a potable source of drinking water. Calculation of summary statistics revealed a lead average of 0.02 mg/L (+/- 0.0 mg/L).

Selenium was detected at a concentration of 0.003 mg/L in well M06004. The MCL for selenium is 0.05 mg/L.

Anions

Fluoride was detected at concentrations well below the 4 mg/L MCL in eight monitoring wells (section 2.1.4). The presence of fluoride is most likely due to the erosion of natural deposits. Calculation of summary statistics revealed a fluoride average of 0.13 mg/L (+/- 0.03 mg/L).

Nitrate was detected at concentrations well below the 10 mg/L MCL in nine monitoring wells (section 2.1.4). The presence of nitrate is most likely due to the erosion of natural deposits and/or runoff from fertilizer use. Once in the soil, nitrate is very mobile due to its water solubility trait and therefore moves easily through the soil matrix at a speed comparable to groundwater flow velocity. Calculation of summary statistics revealed a nitrate average of 0.19 mg/L (+/- 0.34 mg/L).

Nitrite was detected at concentrations of 0.02 mg/L and 0.031 mg/L in wells G06115 and M06005 respectively. Like nitrate, the presence of nitrite is most likely due to the erosion of natural deposits and/or runoff from fertilizer use. Calculation of summary statistics revealed a nitrite average of 0.03 mg/L (+/- 0.01 mg/L).

Radionuclides

Alpha-emitting, beta-emitting, gamma-emitting, and tritium radioisotopes were sampled. Gross alpha was detected in six of the 14 monitoring wells that were analyzed (Figure 1, section 2.1.3). One MCL exceedance was recorded (21 pCi/L) in well M06005. This well is only utilized for monitoring purposes and is not a potable source of drinking water. As the presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state, the concentrations of gross alpha in the five wells not exceeding the MCL are probably due to the natural decay process of uranium deposits within the subsurface. Speciation of M06005 for natural radioisotopes (i.e., radium-226 and total uranium) did not totally account for the elevated alpha level. However, heavy turbidity was noted in the well's samples collected to date, which may account for the elevated alpha concentration. If this situation arises in Fiscal Year 2007, additional speciation (per the groundwater protocols) will be performed. Calculation of summary statistics revealed a gross alpha average of 5.73 pCi/L (+/- 7.71 pCi/L) for the SRS 50-mile perimeter population and an average of 2.22 pCi/L (+/- 0.09 pCi/L) for the South Carolina

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background population. The null hypothesis, indicating no difference between the SRS 50-mile perimeter population and the South Carolina background population, was rejected by the Wilcoxon Rank Sum and modified Quantile tests. However, an approximation of the number of samples to support this conclusion at the 95% confidence level indicated that more sampling is needed. As the SRS 50-mile perimeter population was significantly different than the South Carolina background population, future sampling for specific alpha radioisotopes will be conducted to capture the assignable cause of difference.

Gross non-volatile beta was detected in four of the 14 monitoring wells that were analyzed (Figure 2, section 2.1.3). One MCL exceedance was recorded (8.76 pCi/L) in well M06005. As the presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state, the concentrations of gross non-volatile beta in the three wells not exceeding the MCL are probably due to the natural decay process of uranium deposits within the subsurface. Speciation of M06005 for the natural radioisotope radium-228 did not totally account for the elevated beta level. As noted above, heavy turbidity was noted in the well's samples previously collected which may account for the elevated beta concentrations. Calculation of summary statistics revealed a gross non-volatile beta average of 4.3 pCi/L (+/- 3 pCi/L) for the SRS 50-mile perimeter population.

Various combinations of total uranium, radium-226, and radium-228 were detected at concentrations < 5.0 pCi/L in 13 of the 14 monitoring wells sampled. Calculation of summary statistics revealed a total uranium, radium-226, and radium-228 average of 0.56 mg/L (+/- 1.01 mg/L), 0.68 mg/L (+/- 1.01 mg/L) and 0.35 mg/L (+/- 0.28 mg/L) respectively.

As the presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state, the concentrations of uranium, radium-226, and radium-228 are probably due to the natural decay process of uranium deposits within the subsurface. This naturally occurring radioisotope information will be shared with other SCDHEC programs for tracking and public awareness purposes.

## CONCLUSIONS AND RECOMMENDATIONS

A review of the analytical data revealed various nonradiological and/or radiological constituents in all 14 wells sampled. One of the wells exceeded the EPA MCL for gross alpha, gross non-volatile beta, and lead. As the AGMP is on a rotating sampling schedule, reporting trends in gross alpha and non-volatile beta detections is limited at this time. However, a comparison between past (SCDHEC 2000b & 2001) and current ESOP data revealed that lead concentrations have decreased below the EPA's "action level" of 0.015 mg/L (Figure 3, section 2.1.3).

Tritium was not detected during this round of sampling. However, as stakeholder interests in tritium levels continue to rise (DOE 2006), tritium will be addressed in this and future project reports.

The AGMP attempted to determine if constituents, other than naturally occurring, have impacted the groundwater regime within the AGMN. The results indicate that several non-radiological constituents and naturally occurring radioisotopes are impacting groundwater

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quality. Future speciation of M06005 will attempt to determine if alpha and beta emitters beyond natural radioisotopes along with turbidity levels are affecting the quality of water in the well. Independent monitoring of basic water quality parameters, metals, tritium, gross alpha, non-volatile beta, and gamma-emitting radioisotopes will continue. In addition, statistical analysis of perimeter and background data along with evaluating DOE-SR groundwater monitoring data will be performed. Continued monitoring will provide a better understanding of actual groundwater quality parameter levels, their extent, and trends. As a result, the ability to compare most recent data with historical data can be achieved. In addition, ESOP will provide SCDHEC's Bureau of Water with groundwater data to assist in their evaluation of the extent of naturally occurring radioisotopes in the region.

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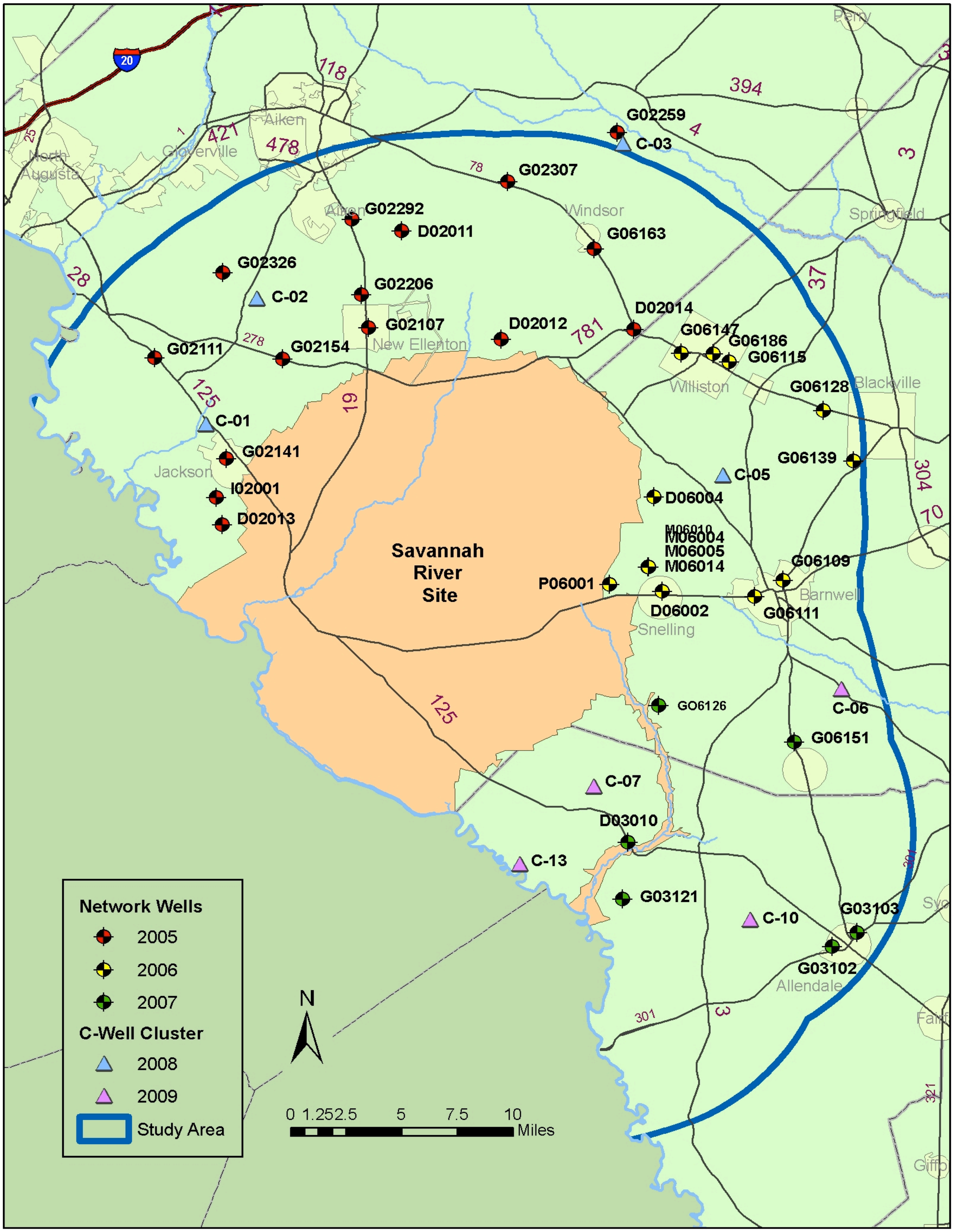
## 2.1.2
## Map 3. Ambient Groundwater Network

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### 2.1.3 Tables and Figures
### Ambient Groundwater Monitoring

Table 1. Summary of Contaminants Detected Above an Established MCL in 2006.

| Well No. | Well Name | Analyte | MCL | Concentration | Aquifer |
|---|---|---|---|---|---|
| M06005 | Chem Nuclear WO0067 | Lead | 15 ug/L | 18 ug/L | UTR |
| " | " | Gross Alpha | 15 pCi/L | 21 pCi/L | " |
| " | " | Gross Non-volatile Beta | 8 pCi/L | 8.76 pCi/L | " |

Figure 1.
Gross Alpha Concentrations

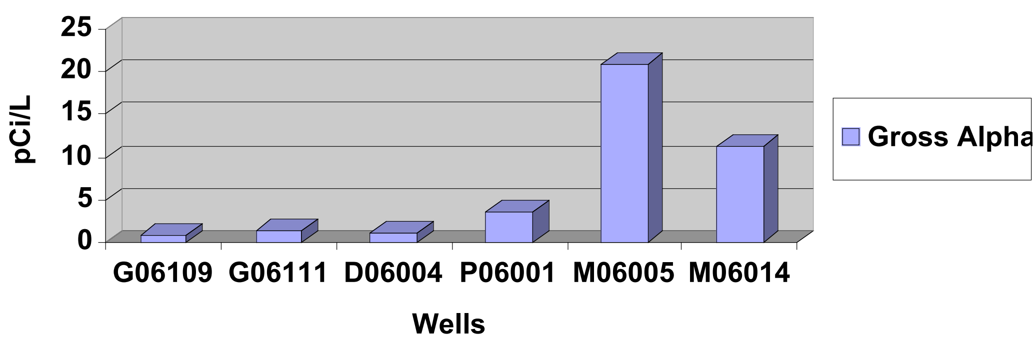
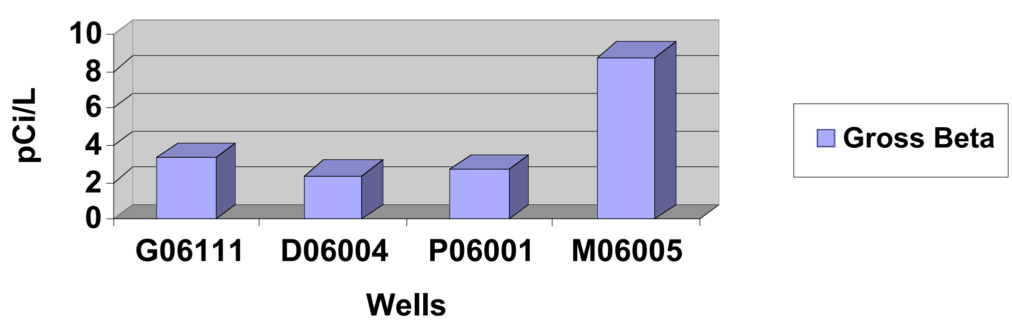



Figure 2.
Gross Non-volatile Beta Concentrations

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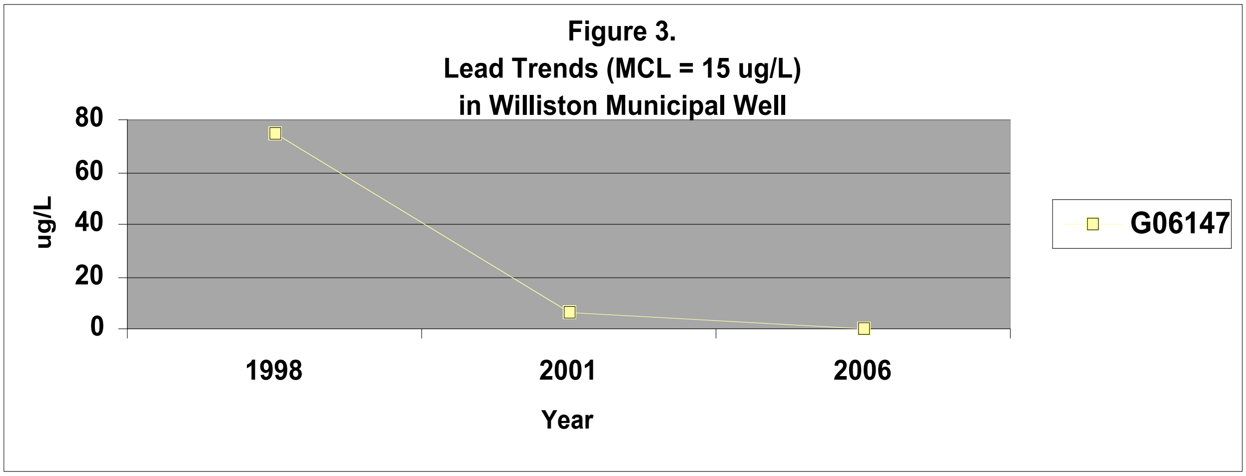
## Tables and Figures
## Ambient Groundwater Monitoring

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## 2.1.4 Data
## Ambient Groundwater Monitoring Data



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## 2.1.4 Data
## Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2006

| | Well Number: | | GWG06147 | | GWG06186 | | GWG06115 | |
|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 06/12/06 | | 06/12/06 | | 06/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Field Measurements | Temperature | (C) | 21.1 | NA | 20.8 | NA | 21.7 | NA |
| | pH | (S.U.) | 4.58 | NA | 5.97 | NA | 6.12 | NA |
| | Conductivity | (mS/cm) | 0.134 | NA | 0.053 | NA | 0.075 | NA |
| | Dissolved Oxygen | (mg/L) | 10.42 | NA | 10.74 | NA | 10.68 | NA |
| | Turbidity | (NTU) | 0 | NA | 0 | NA | 0 | NA |
| | Background Radiation | (uR/hr) | 9.97 | NA | 9.97 | NA | 19.12 | NA |
| | Sample Radiation | (uR/hr) | 5.82 | NA | 14.96 | NA | 18.29 | NA |
| Chemistry | Alkalinity | (mg/L) | 0 | NA | 14 | NA | 26 | NA |
| | Pth. Alkalinity | (mg/L) | 0 | NA | 0 | NA | 0 | NA |
| | Hardness (calculated) | (mg/L) | 5 | NA | 22 | NA | 32 | NA |
| | pH, Lab | (S.U.) | 4.2 | NA | 6.1 | NA | 6.4 | NA |
| | Specific Conductance (@25C) | (umhos/cm) | 52 | NA | 62 | NA | 83 | NA |
| | Total Dissolved Solids | (mg/L) | 33 | NA | 57 | NA | 61 | NA |
| | Total Organic Carbon | (mg/L) | <2.0 | NA | <2.0 | NA | <2.0 | NA |
| | Bromide | (mg/L) | * | NA | * | NA | * | NA |
| | Chloride | (mg/L) | 3.9 | NA | 2.3 | NA | 2.4 | NA |
| | Fluoride (MCL = 4) | (mg/L) | <0.10 | NA | 0.2 | NA | 0.16 | NA |
| | Nitrite (MCL = 1) | (mg/L) | <0.020 | NA | <0.020 | NA | 0.02 | NA |
| | Nitrate/Nitrite | (mg/L) | <0.020 | NA | 0.042 | NA | <0.020 | NA |
| | Nitrate (MCL = 10) | (mg/L) | <0.020 | NA | 0.042 | NA | <0.020 | NA |
| | Ammonia | (mg/L) | 0.19 | NA | 0.087 | NA | 0.053 | NA |
| | Total Kjeldahl Nitrogen | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Phosphate, Ortho. | (mg/L) | 0.058 | NA | 0.52 | NA | 0.18 | NA |
| | Sulfate | (mg/L) | 6.3 | NA | <5.0 | NA | 5.0 | NA |
| Metals | Aluminum | (mg/L) | 0.35 | NA | <0.10 | NA | 0.11 | NA |
| | Antimony (MCL = 0.006) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Arsenic (MCL = 0.010) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Barium (MCL = 2) | (mg/L) | <0.050 | NA | <0.050 | NA | <0.050 | NA |
| | Boron | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Beryllium (MCL = 0.004) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Cadmium (MCL = 0.005) | (mg/L) | <0.00010 | NA | <0.00010 | NA | <0.00010 | NA |
| | Calcium | (mg/L) | 1.6 | NA | 8.2 | NA | 12 | NA |
| | Chromium (MCL = 0.100) | (mg/L) | <0.010 | NA | <0.010 | NA | <0.010 | NA |
| | Cobalt | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Copper (MCL = 1.3) | (mg/L) | 0.019 | NA | <0.010 | NA | <0.010 | NA |
| | Iron | (mg/L) | 0.39 | NA | 0.041 | NA | 1.2 | NA |
| | Lead (MCL = 0.015) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Magnesium | (mg/L) | 0.25 | NA | 0.47 | NA | 0.51 | NA |
| | Manganese | (mg/L) | 0.012 | NA | <0.010 | NA | 0.01 | NA |
| | Mercury (MCL = 0.0002) | (mg/L) | <0.00020 | NA | <0.00020 | NA | <0.00020 | NA |
| | Nickel | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Potassium | (mg/L) | <1.0 | NA | <1.0 | NA | <1.0 | NA |
| | Selenium (MCL = 0.05) | (mg/L) | <0.0020 | NA | <0.0020 | NA | <0.0020 | NA |
| | Silicon | (mg/L) | 5.8 | NA | 9.0 | NA | 6.0 | NA |
| | Silver | (mg/L) | <0.030 | NA | <0.030 | NA | <0.030 | NA |
| | Sodium | (mg/L) | 1.0 | NA | 1.3 | NA | 1.4 | NA |
| | Thallium (MCL = 0.002) | (mg/L) | <0.0010 | NA | <0.0010 | NA | <0.0010 | NA |
| | Vanadium | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Zinc | (mg/L) | 0.046 | NA | 0.013 | NA | 0.023 | NA |

Notes:
1. “NA”= Not analyzed
2. “*”=Analytical Problem

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## Ambient Groundwater Data

| | | | GWG06147 | | GWG06186 | | GWG06115 | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWG06147 | | GWG06186 | | GWG06115 | |
| | Sample Date: | | 06/12/06 | | 06/12/06 | | 06/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | **Tritium (MCL = 20,000)** | **(pCi/L)** | <182 | NA | <182 | NA | <182 | NA |
| | ±2 | **(sigma)** | | | | | | |
| | Gross Alpha (MCL = 15) | **(pCi/L)** | <LLD | NA | <LLD | NA | <LLD | NA |
| | ±2 | **(sigma)** | | | | | | |
| | LLD | **(pCi/L)** | 2.03E+00 | | 2.33E+00 | | 2.50E+00 | |
| | Gross Non-volatile Beta (MCL = 8) | **(pCi/L)** | <LLD | NA | <LLD | NA | <LLD | NA |
| | ±2 | **(sigma)** | | | | | | |
| | LLD | (pCi/L) | 2.86E+00 | | 2.88E+00 | | 2.89E+00 | |
| | Beryllium-7 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **pCi/L)** | 3.65E+01 | | 3.54E+01 | | 3.35E+01 | |
| | Sodium-22 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.78E+00 | | 2.87E+00 | | 3.02E+00 | |
| | Potassium-40 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.61E+01 | | 7.39E+01 | | 7.22E+01 | |
| | Manganese-54 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.84E+00 | | 2.91E+00 | | 2.97E+00 | |
| | Cobalt-58 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 3.21E+00 | | 3.03E+00 | | 3.08E+00 | |
| | Cobalt-60 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.94E+00 | | 2.78E+00 | | 2.68E+00 | |
| | Zinc-65 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 6.15E+00 | | 6.36E+00 | | 6.26E+00 | |
| | Yitrium-88 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.42E+00 | | 2.46E+00 | | 2.47E+00 | |
| | Zirconium-95 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 5.99E+00 | | 5.66E+00 | | 5.74E+00 | |
| | Ruthenium-103 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 4.60E+00 | | 4.34E+00 | | 4.34E+00 | |

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## Ambient Groundwater Data

| | | | GWG06147 | | GWG06186 | | GWG06115 | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWG06147 | | GWG06186 | | GWG06115 | |
| | Sample Date: | | 06/12/06 | | 06/12/06 | | 06/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | Antimony-125 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.37E+00 | | 1.01E+01 | | 1.01E+01 | |
| | Iodine-131 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.45E+01 | | 1.59E+01 | | 1.54E+01 | |
| | Cesium-134 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.05E+00 | | 3.33E+00 | | 3.04E+00 | |
| | Cesium-137 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.40E+00 | | 3.37E+00 | | 3.39E+00 | |
| | Cerium-144 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.50E+01 | | 3.69E+01 | | 3.54E+01 | |
| | Europium-152 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.13E+01 | | 1.18E+01 | | 1.12E+01 | |
| | Europium-154 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 7.78E+00 | | 8.00E+00 | | 8.45E+00 | |
| | Europium-155 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.67E+01 | | 1.69E+01 | | 1.65E+01 | |
| | Lead-212 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.18E+00 | | 8.14E+00 | | 8.04E+00 | |
| | Lead-214 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.50E+00 | | 9.34E+00 | | 8.79E+00 | |
| | Radium-226 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.03E+02 | | 1.05E+02 | | 1.05E+02 | |
| | Actinium-228 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.43E+01 | | 1.46E+01 | | 1.44E+01 | |
| | Thorium-234 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.95E+01 | | 9.99E+01 | | 9.70E+01 | |
| | Americium-241 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.44E+01 | | 3.55E+01 | | 3.39E+01 | |

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## Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2006

| | Well Number: | | GWG06128 | | GWG06139 | | GWG06109 | |
|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 06/13/06 | | 06/13/06 | | 06/15/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Field Measurements | Temperature | (C) | 20.4 | NA | 20.5 | NA | 20.4 | NA |
| | pH | (S.U.) | 6.8 | NA | 7.19 | NA | 6.15 | NA |
| | Conductivity | (mS/cm) | 0.152 | NA | 0.305 | NA | 0.142 | NA |
| | Dissolved Oxygen | (mg/L) | 9.18 | NA | 8.74 | NA | 9.11 | NA |
| | Turbidity | (NTU) | 0 | NA | 0 | NA | 0 | NA |
| | Background Radiation | (uR/hr) | 14.13 | NA | 15.79 | NA | 26.6 | NA |
| | Sample Radiation | (uR/hr) | 14.96 | NA | 14.13 | NA | 14.13 | NA |
| Chemistry | Alkalinity | (mg/L) | 72 | NA | 180 | NA | 50 | NA |
| | Pth. Alkalinity | (mg/L) | 0 | NA | 0 | NA | 0 | NA |
| | Hardness (calculated) | (mg/L) | 75 | NA | 170 | NA | 47 | NA |
| | pH, Lab | (S.U.) | 7.0 | NA | 7.5 | NA | 6.8 | NA |
| | Specific Conductance (@25C) | (umhos/cm) | 170 | NA | 360 | NA | 110 | NA |
| | Total Dissolved Solids | (mg/L) | 130 | NA | 210 | NA | 100 | NA |
| | Total Organic Carbon | (mg/L) | <2.0 | NA | <2.0 | NA | 2.1 | NA |
| | Bromide | (mg/L) | * | NA | * | NA | * | NA |
| | Chloride | (mg/L) | 2.5 | NA | 3.2 | NA | 2.7 | NA |
| | Fluoride (MCL = 4) | (mg/L) | <0.10 | NA | <0.10 | NA | 0.13 | NA |
| | Nitrite (MCL = 1) | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Nitrate/Nitrite | (mg/L) | 0.027 | NA | 0.024 | NA | 0.061 | NA |
| | Nitrate (MCL = 10) | (mg/L) | 0.027 | NA | 0.024 | NA | 0.061 | NA |
| | Ammonia | (mg/L) | * | NA | * | NA | <0.050 | NA |
| | Total Kjeldahl Nitrogen | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Phosphate, Ortho. | (mg/L) | 0.057 | NA | 0.04 | NA | 0.37 | NA |
| | Sulfate | (mg/L) | 8.4 | NA | <5.0 | NA | <5.0 | NA |
| Metals | Aluminum | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Antimony (MCL = 0.006) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Arsenic (MCL = 0.010) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Barium (MCL = 2) | (mg/L) | <0.050 | NA | 0.078 | NA | 0.054 | NA |
| | Boron | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Beryllium (MCL = 0.004) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Cadmium (MCL = 0.005) | (mg/L) | <0.00010 | NA | <0.00010 | NA | <0.00010 | NA |
| | Calcium | (mg/L) | 29 | NA | 64 | NA | 18 | NA |
| | Chromium (MCL = 0.100) | (mg/L) | <0.010 | NA | <0.010 | NA | <0.010 | NA |
| | Cobalt | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Copper (MCL = 1.3) | (mg/L) | <0.010 | NA | <0.010 | NA | <0.010 | NA |
| | Iron | (mg/L) | 0.023 | NA | 0.033 | NA | 0.036 | NA |
| | Lead (MCL = 0.015) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Magnesium | (mg/L) | 0.72 | NA | 1.50 | NA | 0.5 | NA |
| | Manganese | (mg/L) | 0.019 | NA | <0.010 | NA | <0.010 | NA |
| | Mercury (MCL = 0.0002) | (mg/L) | <0.00020 | NA | <0.00020 | NA | <0.00020 | NA |
| | Nickel | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Potassium | (mg/L) | <1.0 | NA | 1.1 | NA | <1.0 | NA |
| | Selenium (MCL = 0.05) | (mg/L) | <0.0020 | NA | <0.0020 | NA | <0.0020 | NA |
| | Silicon | (mg/L) | 13 | NA | 9.7 | NA | 8.6 | NA |
| | Silver | (mg/L) | <0.030 | NA | <0.030 | NA | <0.030 | NA |
| | Sodium | (mg/L) | 1.6 | NA | 2.0 | NA | 1.4 | NA |
| | Thallium (MCL = 0.002) | (mg/L) | <0.0010 | NA | <0.0010 | NA | <0.0010 | NA |
| | Vanadium | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Zinc | (mg/L) | 0.015 | NA | 0.017 | NA | 0.015 | NA |

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## Ambient Groundwater Data

| | Well Number: | | GWG06128 | | GWG06139 | | GWG06109 | |
|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 06/13/06 | | 06/13/06 | | 06/15/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | **Tritium (MCL = 20,000)** | **(pCi/L)** | <182 | NA | <182 | NA | <191 | NA |
| | ±2 | **(sigma)** | | | | | | |
| | Gross Alpha (MCL = 15) | **(pCi/L)** | <LLD | NA | <LLD | NA | 8.19E-01 | NA |
| | ±2 | **(sigma)** | | | | | 7.15E-01 | |
| | LLD | **(pCi/L)** | 3.42E+00 | | 4.28E+00 | | 7.63E-01 | |
| | Gross Non-volatile Beta (MCL = 8) | **(pCi/L)** | <LLD | NA | <LLD | NA | <LLD | NA |
| | ±2 | **(sigma)** | | | | | | |
| | LLD | (pCi/L) | 2.93E+00 | | 2.96E+00 | | 2.16E+00 | |
| | Beryllium-7 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **pCi/L)** | 3.34E+01 | | 3.45E+01 | | 3.62E+01 | |
| | Sodium-22 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.85E+00 | | 2.66E+00 | | 2.93E+00 | |
| | Potassium-40 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 7.40E+01 | | 7.41E+01 | | 7.22E+01 | |
| | Manganese-54 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 3.20E+00 | | 2.94E+00 | | 3.17E+00 | |
| | Cobalt-58 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 3.26E+00 | | 3.36E+00 | | 3.36E+00 | |
| | Cobalt-60 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.67E+00 | | 2.57E+00 | | 2.80E+00 | |
| | Zinc-65 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 6.85E+00 | | 6.57E+00 | | 6.51E+00 | |
| | Yitrium-88 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.59E+00 | | 2.63E+00 | | 2.63E+00 | |
| | Zirconium-95 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 6.97E+00 | | 5.89E+00 | | 6.51E+00 | |
| | Ruthenium-103 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 4.31E+00 | | 4.24E+00 | | 4.56E+00 | |

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## Ambient Groundwater Data

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWG06128 | | GWG06139 | | GWG06109 | |
| | Sample Date: | | 06/13/06 | | 06/13/06 | | 06/15/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | Antimony-125 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.78E+00 | | 1.02E+01 | | 9.92E+00 | |
| | Iodine-131 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.63E+01 | | 1.57E+01 | | 2.18E+01 | |
| | Cesium-134 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.20E+00 | | 3.03E+00 | | 3.01E+00 | |
| | Cesium-137 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.29E+00 | | 3.06E+00 | | 3.22E+00 | |
| | Cerium-144 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.57E+01 | | 3.56E+01 | | 3.63E+01 | |
| | Europium-152 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.13E+01 | | 1.11E+01 | | 1.15E+01 | |
| | Europium-154 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 7.92E+00 | | 7.44E+00 | | 8.16E+00 | |
| | Europium-155 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.69E+01 | | 1.67E+01 | | 1.70E+01 | |
| | Lead-212 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.10E+00 | | 8.24E+00 | | 8.04E+00 | |
| | Lead-214 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.57E+00 | | 8.62E+00 | | 8.22E+00 | |
| | Radium-226 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.08E+02 | | 1.07E+02 | | 9.89E+01 | |
| | Actinium-228 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.40E+01 | | 1.49E+01 | | 1.48E+01 | |
| | Thorium-234 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.88E+01 | | 9.89E+01 | | 9.78E+01 | |
| | Americium-241 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.47E+01 | | 3.42E+01 | | 3.45E+01 | |

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## Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2006

| | Well Number: | | GWG06111 | | GWD06004 | | GWP06001 | |
|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 06/15/06 | | 06/19/06 | | 06/21/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Field Measurements | Temperature | (C) | 21.9 | NA | 20.6 | NA | 23.2 | NA |
| | pH | (S.U.) | 5.5 | NA | 6.63 | NA | 4.37 | NA |
| | Conductivity | (mS/cm) | 0.024 | NA | 0.077 | NA | 0.042 | NA |
| | Dissolved Oxygen | (mg/L) | 9.63 | NA | 9.65 | NA | 9.72 | NA |
| | Turbidity | (NTU) | 0 | NA | 0 | NA | 0 | NA |
| | Background Radiation | (uR/hr) | 11.64 | NA | 9.97 | NA | 17.46 | NA |
| | Sample Radiation | (uR/hr) | 10.8 | NA | 7.49 | NA | 20.37 | NA |
| Chemistry | Alkalinity | (mg/L) | 5.0 | NA | 35 | NA | 0 | NA |
| | Pth. Alkalinity | (mg/L) | 0 | NA | 0 | NA | 0 | NA |
| | Hardness (calculated) | (mg/L) | 5.2 | NA | 34 | NA | 4.4 | NA |
| | pH, Lab | (S.U.) | 5.6 | NA | 6.8 | NA | 4.3 | NA |
| | Specific Conductance (@25C) | (umhos/cm) | 27 | NA | 82 | NA | 56 | NA |
| | Total Dissolved Solids | (mg/L) | 33 | NA | 73 | NA | 37 | NA |
| | Total Organic Carbon | (mg/L) | <2.0 | NA | 2.2 | NA | <2.0 | NA |
| | Bromide | (mg/L) | * | NA | * | NA | * | NA |
| | Chloride | (mg/L) | 2.8 | NA | 1.6 | NA | 1.6 | NA |
| | Fluoride (MCL = 4) | (mg/L) | <0.10 | NA | 0.15 | NA | <0.10 | NA |
| | Nitrite (MCL = 1) | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Nitrate/Nitrite | (mg/L) | 0.26 | NA | 0.045 | NA | <0.020 | NA |
| | Nitrate (MCL = 10) | (mg/L) | 0.26 | NA | 0.045 | NA | <0.020 | NA |
| | Ammonia | (mg/L) | <0.050 | NA | <0.050 | NA | <0.050 | NA |
| | Total Kjeldahl Nitrogen | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Phosphate, Ortho. | (mg/L) | 0.210 | NA | 0.83 | NA | 0.02 | NA |
| | Sulfate | (mg/L) | <5.0 | NA | <5.0 | NA | 12 | NA |
| Metals | Aluminum | (mg/L) | <0.10 | NA | <0.10 | NA | 0.24 | NA |
| | Antimony (MCL = 0.006) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Arsenic (MCL = 0.010) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Barium (MCL = 2) | (mg/L) | <0.050 | NA | <0.050 | NA | <0.050 | NA |
| | Boron | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Beryllium (MCL = 0.004) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Cadmium (MCL = 0.005) | (mg/L) | <0.00010 | NA | <0.00010 | NA | <0.00010 | NA |
| | Calcium | (mg/L) | 1.5 | NA | 13 | NA | 1.2 | NA |
| | Chromium (MCL = 0.100) | (mg/L) | <0.010 | NA | <0.010 | NA | <0.010 | NA |
| | Cobalt | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Copper (MCL = 1.3) | (mg/L) | <0.010 | NA | <0.010 | NA | <0.010 | NA |
| | Iron | (mg/L) | 0.044 | NA | 0.036 | NA | 0.72 | NA |
| | Lead (MCL = 0.015) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Magnesium | (mg/L) | 0.36 | NA | 0.31 | NA | 0.33 | NA |
| | Manganese | (mg/L) | <0.010 | NA | <0.010 | NA | 0.026 | NA |
| | Mercury (MCL = 0.0002) | (mg/L) | <0.00020 | NA | <0.00020 | NA | <0.00020 | NA |
| | Nickel | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Potassium | (mg/L) | <1.0 | NA | <1.0 | NA | 1.3 | NA |
| | Selenium (MCL = 0.05) | (mg/L) | <0.0020 | NA | <0.0020 | NA | <0.0020 | NA |
| | Silicon | (mg/L) | 6.7 | NA | 13 | NA | 5.0 | NA |
| | Silver | (mg/L) | <0.030 | NA | <0.030 | NA | <0.030 | NA |
| | Sodium | (mg/L) | 1.4 | NA | 0.92 | NA | 1.3 | NA |
| | Thallium (MCL = 0.002) | (mg/L) | <0.0010 | NA | <0.0010 | NA | <0.0010 | NA |
| | Vanadium | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Zinc | (mg/L) | 0.011 | NA | <0.010 | NA | 0.059 | NA |

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# Ambient Groundwater Data

| | | | GWG06111 | | GWD06004 | | GWP06001 | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWG06111 | | GWD06004 | | GWP06001 | |
| | Sample Date: | | 06/15/06 | | 06/19/06 | | 06/21/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | **Tritium (MCL = 20,000)** | (pCi/L) | <191 | NA | <191 | NA | <191 | NA |
| | ±2 | (sigma) | | | | | | |
| | Gross Alpha (MCL = 15) | (pCi/L) | 1.42E+00 | NA | 1.06E+00 | NA | 3.63E+00 | NA |
| | ±2 | (sigma) | 7.69E-01 | | 7.47E-01 | | 1.17E+00 | |
| | LLD | (pCi/L) | 6.02E-01 | | 7.04E-01 | | 6.04E-01 | |
| | Gross Non-volatile Beta (MCL = 8) | (pCi/L) | 3.35E+00 | NA | 2.41E+00 | NA | 2.69E+00 | NA |
| | ±2 | (sigma) | 1.34E+00 | | 1.28E+00 | | 1.32E+00 | |
| | LLD | (pCi/L) | 2.12E+00 | | 2.14E+00 | | 2.12E+00 | |
| | Beryllium-7 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | pCi/L) | 3.51E+01 | | 3.39E+01 | | 3.31E+01 | |
| | Sodium-22 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 2.97E+00 | | 2.91E+00 | | 2.60E+00 | |
| | Potassium-40 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 7.27E+01 | | 7.39E+01 | | 7.19E+01 | |
| | Manganese-54 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.04E+00 | | 3.04E+00 | | 3.09E+00 | |
| | Cobalt-58 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.10E+00 | | 3.33E+00 | | 3.10E+00 | |
| | Cobalt-60 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 2.70E+00 | | 2.87E+00 | | 2.72E+00 | |
| | Zinc-65 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 6.30E+00 | | 6.48E+00 | | 5.93E+00 | |
| | Yitrium-88 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 2.46E+00 | | 2.53E+00 | | 2.75E+00 | |
| | Zirconium-95 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 6.45E+00 | | 5.95E+00 | | 5.83E+00 | |
| | Ruthenium-103 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 4.72E+00 | | 4.47E+00 | | 4.34E+00 | |

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## Ambient Groundwater Data

| | | | GWG06111 | | GWD06004 | | GWP06001 | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWG06111 | | GWD06004 | | GWP06001 | |
| | Sample Date: | | 06/15/06 | | 06/19/06 | | 06/21/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Radionuclides | Antimony-125 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.80E+00 | | 1.02E+01 | | 9.67E+00 | |
| | Iodine-131 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 2.28E+01 | | 1.67E+01 | | 1.40E+01 | |
| | Cesium-134 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.11E+00 | | 3.15E+00 | | 3.00E+00 | |
| | Cesium-137 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.14E+00 | | 3.32E+00 | | 3.20E+00 | |
| | Cerium-144 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.55E+01 | | 3.66E+01 | | 3.60E+01 | |
| | Europium-152 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.15E+01 | | 1.10E+01 | | 1.11E+01 | |
| | Europium-154 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.27E+00 | | 8.06E+00 | | 7.23E+00 | |
| | Europium-155 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.68E+01 | | 1.69E+01 | | 1.70E+01 | |
| | Lead-212 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.32E+00 | | 7.67E+00 | | 8.12E+00 | |
| | Lead-214 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.21E+00 | | 9.22E+00 | | 8.62E+00 | |
| | Radium-226 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.04E+02 | | 1.03E+02 | | 1.04E+02 | |
| | Actinium-228 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.47E+01 | | 1.42E+01 | | 1.44E+01 | |
| | Thorium-234 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 9.90E+01 | | 9.91E+01 | | 9.87E+01 | |
| | Americium-241 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.46E+01 | | 3.47E+01 | | 3.42E+01 | |

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## Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2006

| | Well Number: | | GWD06002 | | GWM06010 | | GWM06005 | |
|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 06/29/06 | | 07/12/06 | | 07/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Field Measurements | Temperature | (C) | 20.7 | NA | 20.3 | NA | 19.6 | NA |
| | pH | (S.U.) | 4.9 | NA | 7.9 | NA | 5.3 | NA |
| | Conductivity | (mS/cm) | 0.019 | NA | 0.087 | NA | 0.014 | NA |
| | Dissolved Oxygen | (mg/L) | 11.62 | NA | 8.72 | NA | 7.29 | NA |
| | Turbidity | (NTU) | 0 | NA | 0 | NA | 0 | NA |
| | Background Radiation | (uR/hr) | 16.63 | NA | 8.31 | NA | 8.31 | NA |
| | Sample Radiation | (uR/hr) | 11.64 | NA | 14.13 | NA | 12.21 | NA |
| Chemistry | Alkalinity | (mg/L) | <1.0 | NA | 54 | NA | 2.0 | NA |
| | Pth. Alkalinity | (mg/L) | 0 | NA | <1.0 | NA | 0 | NA |
| | Hardness (calculated) | (mg/L) | 3.5 | NA | 44 | NA | 15 | NA |
| | pH, Lab | (S.U.) | 4.8 | NA | 8.4 | NA | 5.4 | NA |
| | Specific Conductance (@25C) | (umhos/cm) | 21 | NA | 120 | NA | 17 | NA |
| | Total Dissolved Solids | (mg/L) | 22 | NA | 79 | NA | 30 | NA |
| | Total Organic Carbon | (mg/L) | <2.0 | NA | <2.0 | NA | 2.3 | NA |
| | Bromide | (mg/L) | * | NA | * | NA | * | NA |
| | Chloride | (mg/L) | 2.3 | NA | 1.8 | NA | 2.2 | NA |
| | Fluoride (MCL = 4) | (mg/L) | 0.1 | NA | 0.11 | NA | 0.1 | NA |
| | Nitrite (MCL = 1) | (mg/L) | <0.020 | NA | <0.020 | NA | 0.031 | NA |
| | Nitrate/Nitrite | (mg/L) | 1.2 | NA | 0.028 | NA | 0.36 | NA |
| | Nitrate (MCL = 10) | (mg/L) | 1.2 | NA | 0.028 | NA | 0.329 | NA |
| | Ammonia | (mg/L) | 0.073 | NA | 0.09 | NA | 0.091 | NA |
| | Total Kjeldahl Nitrogen | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Phosphate, Ortho. | (mg/L) | 0.13 | NA | <0.020 | NA | 0.07 | NA |
| | Sulfate | (mg/L) | <5.0 | NA | <5.0 | NA | <5.0 | NA |
| Metals | Aluminum | (mg/L) | <0.10 | NA | <0.10 | NA | 27 | NA |
| | Antimony (MCL = 0.006) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Arsenic (MCL = 0.010) | (mg/L) | <0.0050 | NA | <0.0050 | NA | <0.0050 | NA |
| | Barium (MCL = 2) | (mg/L) | <0.050 | NA | <0.050 | NA | 0.18 | NA |
| | Boron | (mg/L) | <0.10 | NA | <0.10 | NA | <0.10 | NA |
| | Beryllium (MCL = 0.004) | (mg/L) | <0.0030 | NA | <0.0030 | NA | <0.0030 | NA |
| | Cadmium (MCL = 0.005) | (mg/L) | <0.00010 | NA | <0.00010 | NA | <0.00010 | NA |
| | Calcium | (mg/L) | 0.61 | NA | 17 | NA | 3.2 | NA |
| | Chromium (MCL = 0.100) | (mg/L) | <0.010 | NA | <0.010 | NA | 0.084 | NA |
| | Cobalt | (mg/L) | <0.020 | NA | <0.020 | NA | <0.020 | NA |
| | Copper (MCL = 1.3) | (mg/L) | 0.011 | NA | <0.010 | NA | 0.071 | NA |
| | Iron | (mg/L) | 0.2 | NA | 0.41 | NA | 24 | NA |
| | Lead (MCL = 0.015) | (mg/L) | <0.0050 | NA | <0.0050 | NA | 0.018 | NA |
| | Magnesium | (mg/L) | 0.49 | NA | 0.30 | NA | 1.80 | NA |
| | Manganese | (mg/L) | <0.010 | NA | <0.010 | NA | 0.24 | NA |
| | Mercury (MCL = 0.0002) | (mg/L) | <0.00020 | NA | <0.00020 | NA | <0.00020 | NA |
| | Nickel | (mg/L) | <0.020 | NA | <0.020 | NA | 0.053 | NA |
| | Potassium | (mg/L) | <1.0 | NA | <1.0 | NA | 1.1 | NA |
| | Selenium (MCL = 0.05) | (mg/L) | <0.0020 | NA | <0.0020 | NA | <0.0020 | NA |
| | Silicon | (mg/L) | 2.8 | NA | 6.2 | NA | 7.5 | NA |
| | Silver | (mg/L) | <0.030 | NA | <0.030 | NA | <0.030 | NA |
| | Sodium | (mg/L) | 1.0 | NA | 1.0 | NA | 0.88 | NA |
| | Thallium (MCL = 0.002) | (mg/L) | <0.0010 | NA | <0.0010 | NA | <0.0010 | NA |
| | Vanadium | (mg/L) | <0.020 | NA | <0.020 | NA | 0.064 | NA |
| | Zinc | (mg/L) | <0.010 | NA | <0.010 | NA | 0.064 | NA |

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## Ambient Groundwater Data

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWD06002 | | GWM06010 | | GWM06005 | |
| | Sample Date: | | 06/29/06 | | 07/12/06 | | 07/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | **Tritium (MCL = 20,000)** | **(pCi/L)** | <191 | NA | <191 | NA | <191 | NA |
| | ±2 | **(sigma)** | | | | | | |
| | Gross Alpha (MCL = 15) | **(pCi/L)** | <LLD | NA | <LLD | NA | 2.10E+01 | NA |
| | ±2 | **(sigma)** | | | | | 3.91E+00 | |
| | LLD | **(pCi/L)** | 2.02E+00 | | 2.52E+00 | | 3.65E+00 | |
| | Gross Non-volatile Beta (MCL = 8) | **(pCi/L)** | <LLD | NA | <LLD | NA | 8.76E+00 | NA |
| | ±2 | **(sigma)** | | | | | 2.01E+00 | |
| | LLD | (pCi/L) | 2.76E+00 | | 2.80E+00 | | 2.88E+00 | |
| | Beryllium-7 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **pCi/L)** | 4.59E+01 | | 3.700E+01 | | 3.769E+01 | |
| | Sodium-22 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.81E+00 | | 3.115E+00 | | 3.104E+00 | |
| | Potassium-40 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 7.60E+01 | | 7.657E+01 | | 7.886E+01 | |
| | Manganese-54 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 3.16E+00 | | 3.008E+00 | | 3.011E+00 | |
| | Cobalt-58 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 4.14E+00 | | 3.345E+00 | | 3.830E+00 | |
| | Cobalt-60 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 2.60E+00 | | 2.707E+00 | | 2.924E+00 | |
| | Zinc-65 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 7.14E+00 | | 6.309E+00 | | 6.708E+00 | |
| | Yitrium-88 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 3.42E+00 | | 2.640E+00 | | 2.952E+00 | |
| | Zirconium-95 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 8.10E+00 | | 6.657E+00 | | 6.523E+00 | |
| | Ruthenium-103 | **(pCi/L)** | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | | | |
| | MDA | **(pCi/L)** | 6.07E+00 | | 4.742E+00 | | 4.854E+00 | |

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## Ambient Groundwater Data

| | | | GWD06002 | | GWM06010 | | GWM06005 | |
|---|---|---|---|---|---|---|---|---|
| | Well Number: | | GWD06002 | | GWM06010 | | GWM06005 | |
| | Sample Date: | | 06/29/06 | | 07/12/06 | | 07/12/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Radionuclides | Antimony-125 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.03E+01 | | 1.001E+01 | | 1.004E+01 | |
| | Iodine-131 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.35E+01 | | 2.489E+01 | | 2.566E+01 | |
| | Cesium-134 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.04E+00 | | 3.089E+00 | | 3.044E+00 | |
| | Cesium-137 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.39E+00 | | 3.336E+00 | | 3.482E+00 | |
| | Cerium-144 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.90E+01 | | 3.597E+01 | | 3.704E+01 | |
| | Europium-152 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.10E+01 | | 1.130E+01 | | 1.137E+01 | |
| | Europium-154 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 7.79E+00 | | 8.645E+00 | | 8.665E+00 | |
| | Europium-155 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.67E+01 | | 1.708E+01 | | 1.740E+01 | |
| | Lead-212 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 7.96E+00 | | 8.234E+00 | | 8.380E+00 | |
| | Lead-214 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 8.59E+00 | | 8.749E+00 | | 9.629E+00 | |
| | Radium-226 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.06E+02 | | 1.093E+02 | | 1.043E+02 | |
| | Actinium-228 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.54E+01 | | 1.441E+01 | | 1.533E+01 | |
| | Thorium-234 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 1.01E+02 | | 1.014E+02 | | 1.036E+02 | |
| | Americium-241 | (pCi/L) | <MDA | NA | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | | | |
| | MDA | (pCi/L) | 3.40E+01 | | 3.502E+01 | | 3.548E+01 | |

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## Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2006

| | Well Number: | | GWM06014 | | GWM06004 | |
|---|---|---|---|---|---|---|
| | Sample Date: | | 07/13/06 | | 07/13/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved |
| Field Measurements | **Temperature** | **(C)** | 22.8 | NA | 21.9 | NA |
| | **pH** | **(S.U.)** | 11.11 | NA | 11 | NA |
| | **Conductivity** | **(mS/cm)** | 2.8 | NA | 2.8 | NA |
| | **Dissolved Oxygen** | **(mg/L)** | 9.61 | NA | 8.04 | NA |
| | **Turbidity** | **(NTU)** | 0 | NA | 0 | NA |
| | **Background Radiation** | **(uR/hr)** | 11.64 | NA | 11.64 | NA |
| | **Sample Radiation** | **(uR/hr)** | 5.82 | NA | 8.31 | NA |
| Chemistry | **Alkalinity** | **(mg/L)** | * | NA | * | NA |
| | **Pth. Alkalinity** | **(mg/L)** | * | NA | * | NA |
| | **Hardness (calculated)** | **(mg/L)** | 470 | NA | 61 | NA |
| | **pH, Lab** | **(S.U.)** | * | NA | * | NA |
| | **Specific Conductance (@25C)** | **(umhos/cm)** | 3.3 | NA | 210 | NA |
| | **Total Dissolved Solids** | **(mg/L)** | 700 | NA | 130 | NA |
| | **Total Organic Carbon** | **(mg/L)** | <2.0 | NA | <2.0 | NA |
| | **Bromide** | **(mg/L)** | * | NA | * | NA |
| | **Chloride** | **(mg/L)** | 1.8 | NA | 2.3 | NA |
| | **Fluoride (MCL = 4)** | **(mg/L)** | 0.1 | NA | 0.1 | NA |
| | **Nitrite (MCL = 1)** | **(mg/L)** | <0.020 | NA | <0.020 | NA |
| | **Nitrate/Nitrite** | **(mg/L)** | 0.031 | NA | <0.020 | NA |
| | **Nitrate (MCL = 10)** | **(mg/L)** | 0.031 | NA | <0.020 | NA |
| | **Ammonia** | **(mg/L)** | <0.050 | NA | <0.050 | NA |
| | **Total Kjeldahl Nitrogen** | **(mg/L)** | <0.10 | NA | 0.17 | NA |
| | **Phosphate, Ortho.** | **(mg/L)** | <0.020 | NA | 0.12 | NA |
| | **Sulfate** | **(mg/L)** | <5.0 | NA | 7.0 | NA |
| **Metals** | **Aluminum** | **(mg/L)** | 1.4 | NA | 0.14 | NA |
| | **Antimony (MCL = 0.006)** | **(mg/L)** | <0.0030 | NA | <0.0030 | NA |
| | **Arsenic (MCL = 0.010)** | **(mg/L)** | <0.0050 | NA | <0.0050 | NA |
| | **Barium (MCL = 2)** | **(mg/L)** | 0.21 | NA | 0.061 | NA |
| | **Boron** | **(mg/L)** | <0.10 | NA | <0.10 | NA |
| | **Beryllium (MCL = 0.004)** | **(mg/L)** | <0.0030 | NA | <0.0030 | NA |
| | **Cadmium (MCL = 0.005)** | **(mg/L)** | <0.00010 | NA | <0.00010 | NA |
| | **Calcium** | **(mg/L)** | 190 | NA | 24 | NA |
| | **Chromium (MCL = 0.100)** | **(mg/L)** | <0.010 | NA | <0.010 | NA |
| | **Cobalt** | **(mg/L)** | <0.020 | NA | <0.020 | NA |
| | **Copper (MCL = 1.3)** | **(mg/L)** | <0.010 | NA | <0.010 | NA |
| | **Iron** | **(mg/L)** | 0.028 | NA | 0.13 | NA |
| | **Lead (MCL = 0.015)** | **(mg/L)** | <0.0050 | NA | 0.013 | NA |
| | **Magnesium** | **(mg/L)** | <0.050 | NA | 0.18 | NA |
| | **Manganese** | **(mg/L)** | <0.010 | NA | <0.010 | NA |
| | **Mercury (MCL = 0.0002)** | **(mg/L)** | <0.00020 | NA | <0.00020 | NA |
| | **Nickel** | **(mg/L)** | <0.020 | NA | <0.020 | NA |
| | **Potassium** | **(mg/L)** | 9.8 | NA | 1.2 | NA |
| | **Selenium (MCL = 0.05)** | **(mg/L)** | <0.0020 | NA | 0.003 | NA |
| | **Silicon** | **(mg/L)** | 0.95 | NA | 6.7 | NA |
| | **Silver** | **(mg/L)** | <0.030 | NA | <0.030 | NA |
| | **Sodium** | **(mg/L)** | 6.2 | NA | 0.96 | NA |
| | **Thallium (MCL = 0.002)** | **(mg/L)** | <0.0010 | NA | <0.0010 | NA |
| | **Vanadium** | **(mg/L)** | <0.020 | NA | <0.020 | NA |
| | **Zinc** | **(mg/L)** | <0.010 | NA | <0.010 | NA |

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## Ambient Groundwater Data

| | | | GWM06014 | | GWM06004 | |
|---|---|---|---|---|---|---|
| | Well Number: | | GWM06014 | | GWM06004 | |
| | Sample Date: | | 07/13/06 | | 07/13/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | **Tritium (MCL = 20,000)** | **(pCi/L)** | <191 | NA | <191 | NA |
| | ±2 | **(sigma)** | | | | |
| | Gross Alpha (MCL = 15) | **(pCi/L)** | 1.13E+01 | NA | <LLD | NA |
| | ±2 | **(sigma)** | 4.42E+00 | | | |
| | LLD | **(pCi/L)** | 5.98E+00 | | 2.68E+00 | |
| | Gross Non-volatile Beta (MCL = 8) | **(pCi/L)** | <LLD | NA | <LLD | NA |
| | ±2 | **(sigma)** | | | | |
| | LLD | (pCi/L) | 5.65E+00 | | 2.81E+00 | |
| | Beryllium-7 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **pCi/L)** | 3.600E+01 | | 3.935E+01 | |
| | Sodium-22 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 2.546E+00 | | 2.998E+00 | |
| | Potassium-40 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 7.565E+01 | | 8.136E+01 | |
| | Manganese-54 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 2.974E+00 | | 3.045E+00 | |
| | Cobalt-58 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 3.380E+00 | | 3.770E+00 | |
| | Cobalt-60 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 2.899E+00 | | 2.881E+00 | |
| | Zinc-65 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 5.991E+00 | | 6.680E+00 | |
| | Yitrium-88 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 2.678E+00 | | 2.525E+00 | |
| | Zirconium-95 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 6.220E+00 | | 6.903E+00 | |
| | Ruthenium-103 | **(pCi/L)** | <MDA | NA | <MDA | NA |
| | ±2 | **(sigma)** | | | | |
| | MDA | **(pCi/L)** | 4.926E+00 | | 5.193E+00 | |

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## Ambient Groundwater Data

| | | | GWM06014 | | GWM06004 | |
|---|---|---|---|---|---|---|
| | Well Number: | | GWM06014 | | GWM06004 | |
| | Sample Date: | | 07/13/06 | | 07/13/06 | |
| | Sample Type: | | Total | Dissolved | Total | Dissolved |
| **Radionuclides** | Antimony-125 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 1.037E+01 | | 1.037E+01 | |
| | Iodine-131 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 2.396E+01 | | 3.528E+01 | |
| | Cesium-134 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 3.241E+00 | | 2.990E+00 | |
| | Cesium-137 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 3.299E+00 | | 3.425E+00 | |
| | Cerium-144 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 3.672E+01 | | 3.784E+01 | |
| | Europium-152 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 1.115E+01 | | 1.147E+01 | |
| | Europium-154 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 7.061E+00 | | 8.352E+00 | |
| | Europium-155 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 1.653E+01 | | 1.682E+01 | |
| | Lead-212 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 8.060E+00 | | 8.327E+00 | |
| | Lead-214 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 8.513E+00 | | 8.591E+00 | |
| | Radium-226 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 9.795E+01 | | 1.053E+02 | |
| | Actinium-228 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 1.365E+01 | | 1.566E+01 | |
| | Thorium-234 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 9.853E+01 | | 1.024E+02 | |
| | Americium-241 | (pCi/L) | <MDA | NA | <MDA | NA |
| | ±2 | (sigma) | | | | |
| | MDA | (pCi/L) | 3.549E+01 | | 3.542E+01 | |

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## 2.1.5 Summary Statistics
## Ambient Groundwater

Nonrandom Background

| Analyte | Statistics | Concentration (pCi/L) |
|---|---|---|
| Gross Alpha | Average | 2.22 |
| | Standard Deviation | 0.09 |
| | Median | 2.22 |
| Gross Non-volatile Beta | Average | N/A |
| | Standard Deviation | N/A |
| | Median | N/A |
| Potassium-40 | Average | N/A |
| | Standard Deviation | N/A |
| | Median | N/A |

Nonrandom Perimeter

| Analyte | Statistics | Concentration (pCi/L) |
|---|---|---|
| Gross Alpha | Average | 5.73 |
| | Standard Deviation | 7.71 |
| | Median | 1.42 |
| Gross Non-volatile Beta | Average | 4.30 |
| | Standard Deviation | 3.00 |
| | Median | 3.02 |
| Potassium 40 | Average | N/A |
| | Standard Deviation | N/A |
| | Median | N/A |

Random Perimeter

| Analyte | Statistics | Concentration (pCi/L) |
|---|---|---|
| Gross Alpha | Average | 11.26 |
| | Standard Deviation | 7.58 |
| | Median | 14.10 |
| Gross Non-volatile Beta | Average | N/A |
| | Standard Deviation | N/A |
| | Median | N/A |
| Potassium-40 | Average | N/A |
| | Standard Deviation | N/A |
| | Median | N/A |

*RP - No detects for gross beta & potassium-40
RB - No detects for gross alpha, beta & potassium-40
B wells = St. George, Manning, Bishopville, Saluda, Redbank, St. Matthews, Sumter, Timmonsville
E wells = Salley, Blackville, Aiken, Ehrhardt, Allendale

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## 2.2 Drinking Water Quality Monitoring

### 2.2.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) Drinking Water Monitoring Project evaluates drinking water quality to provide assurance to the public that community drinking water systems adjacent and downstream to the Savannah River Site (SRS) have not been impacted by radiological constituents. The project objectives are to collect monthly composite surface water samples from water treatment plants using the lower portion of the Savannah River, and to collect semi-annual grab samples from selected community, mostly groundwater fed, drinking water systems within 30 miles of SRS. The South Carolina Department of Health and Environmental Control (SCDHEC) analyzes samples for gross alpha, nonvolatile beta, gamma-emitting radionuclides, and tritium.

The study area was established as a 30-mile radius circle centered in SRS. All community drinking water systems in the study area were identified using the SCDHEC Geographical Information System. Of the systems selected, 17 were mostly groundwater fed and three were surface water fed systems. These systems serve approximately 220,000 customers with approximately 96,000 receiving their water from groundwater sources. Table 1 in section 2.2.3 shows the water systems sampled by SCDHEC. Monthly and semi-annual samples were labeled, preserved, and transferred to a laboratory with a chain-of-custody. Samples were submitted to the Region 5 Aiken Environmental Quality Control Laboratory for tritium analysis. SCDHEC Radiological Environmental Monitoring Division (REMD) conducted gamma spectroscopy, gross alpha, and gross nonvolatile beta analyses. All data collected was verified, validated, and stored in project files and spreadsheets.

The ESOP Drinking Water Monitoring Project continues to be an important source of essential data for assessing human health exposure pathways. ESOP will continue enhanced sampling to provide the public with an independent source of radiological data for drinking water systems within the SRS study area.

**RESULTS AND DISCUSSION**

<u>Groundwater System Results</u>

Based on a review of the analytical data, three of the 17 groundwater fed systems sampled had tritium activities above the Lower Limit of Detection (LLD). The detected tritium activities ranged from 205 to 327 pCi/L with an average of 265.5 ± 53.39 pCi/L. These tritium activities are measurable but not significant when compared with the 20,000 picocuries per liter (pCi/L) United States Environmental Protection Agency maximum contaminant level (MCL) (USEPA 2002a). The most consistent detections are found in the three locations closest to SRS. Elevated tritium activities can be attributed to the atmospheric fallout from the nuclear facilities present within the study area. The tritium activity is potentially due to rainwater infiltration into the unconsolidated aquifer that is present in this area. Analytical results for groundwater fed systems are located in section 2.2.4. Figure 1, section 2.2.3. shows trending data from the past six years for the samples from groundwater fed systems that showed detects.

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Gamma-emitting radionuclides were not detected above the Minimum Detectable Activity (MDA). Gross alpha was detected in six of the systems. All gross alpha samples were below the EPA MCL of 15 pCi/L (USEPA 2002a). Gross non-volatile beta was detected in seven of the

systems. All gross beta samples were below the EPA MCL of 8 pCi/L (USEPA 2002a). If gross alpha and non-volatile beta exceed the trigger levels of >15 pCi/L or > 8 pCi/L respectively, samples will be re-analyzed for isotopic parameters.

Surface Water Results

Based on a review of the surface water data from the Savannah River, tritium was detected above the LLD in all of the surface water intakes. Detectable tritium activity in these samples had an average of 455.16 ± 144.7 pCi/L and ranged from 216 to 1088 pCi/L. Of the background North Augusta surface water composites, there was only one detection above the LLD. Tritium activity in the North Augusta sample was 241pCi/L. Tritium activity in the three downstream intakes, Beaufort/Jasper Chelsea Plant, Beaufort/Jasper Purrysburg Plant, and City of Savannah samples had an average of 526.54 ± 43.74 pCi/L. The detectable tritium in the background surface water location was within five standard deviations of the downstream locations. Tritium activities for the surface water composites is summarized in section 2.2.4. Figure 2, section 2.2.3 shows the trending data for surface water fed systems over the past six years.

Gamma-emitting radionuclides were not detected above the Cs-137 MDA for the monthly surface water composite samples. Gross alpha was not detected above the MDA. Gross non-volatile beta was detected in both City of Savannah and both Beaufort/Jasper locations. The yearly detectable average was 3.551 ± 0.375 pCi/L and ranged from 2.99 to 3.96 pCi/L. The detected beta activity is likely attributable to naturally occurring radionuclides. Speciation is not done for beta unless there is a detection above the EPA MCL of 8 pCi/L. Analytical results for the surface water composite samples are summarized in section 2.2.4.

Groundwater and Surface Water Statistical Comparison

The gross alpha detectable average for groundwater systems in 2006 was 3.63 ± 1.34 pCi/L. Gross alpha was not detected in surface water above the MDA. The non-volatile beta detectable average for groundwater systems was 3.22 ± 0.83 pCi/L and 3.551 ± 0.375 pCi/L in surface water. The tritium detectable average for groundwater systems was 265.5 ± 53.39 pCi/L. There was only one tritium detect for the surface water background location, North Augusta at 241.0 pCi/L.

The detectable gross non-volatile beta in surface water was within one standard deviation of groundwater systems. There were no detectable gamma-emitting radionuclides found in either surface water or groundwater systems in 2006. The detectable tritium in the background surface water location was within one standard deviation of groundwater systems.

Department of Energy-Savannah River (DOE-SR) Data Comparison

DOE-SR conducts monthly composite sampling at the four water treatment plants using the Savannah River. Based on the DOE-SR 2007 annual report, tritium in the three downstream

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water intakes averaged 305 pCi/L and ranged from 184 to 1500 pCi/L (WSRC 2007). Figure 3, section 2.2.3 shows the ESOP/DOE-SR comparison of tending tritium data over the past six years.

Except for North Augusta, DOE-SR detected tritium levels have been consistently slightly higher than ESOP. Although tritium continues to be the most abundant radionuclide in the Savannah River, the tritium levels have been consistently decreasing over the past six years.

Gross alpha, nonvolatile beta, and gamma-emitting radionuclides detected by DOE-SR were below SCDHEC MCLs.

**CONCLUSIONS AND RECOMMENDATIONS**

Tritium continues to be the most abundant radionuclide detected in public drinking water supplies potentially impacted by SRS. Tritium was detected in both groundwater and surface water systems. However, these tritium activities were relatively low considering the 20,000 pCi/L MCL for drinking water. Gross alpha, gross beta, and gamma-emitting radionuclides were not detected at activities above their respective MCLs. Comparative analysis with DOE-SR for groundwater systems cannot be done, because DOE-SR does not sample systems off of the Savannah River Site.

A copy of the analytical data reports and sample log sheets are contained in the project file. SCDHEC will continue sampling to provide the public with an independent source of radiological data for groundwater systems. More background samples will be taken in the future to give a better idea of what naturally occurring radioactivity levels are in South Carolina. The data from these samples will be used in statistical analysis with the routine samples.

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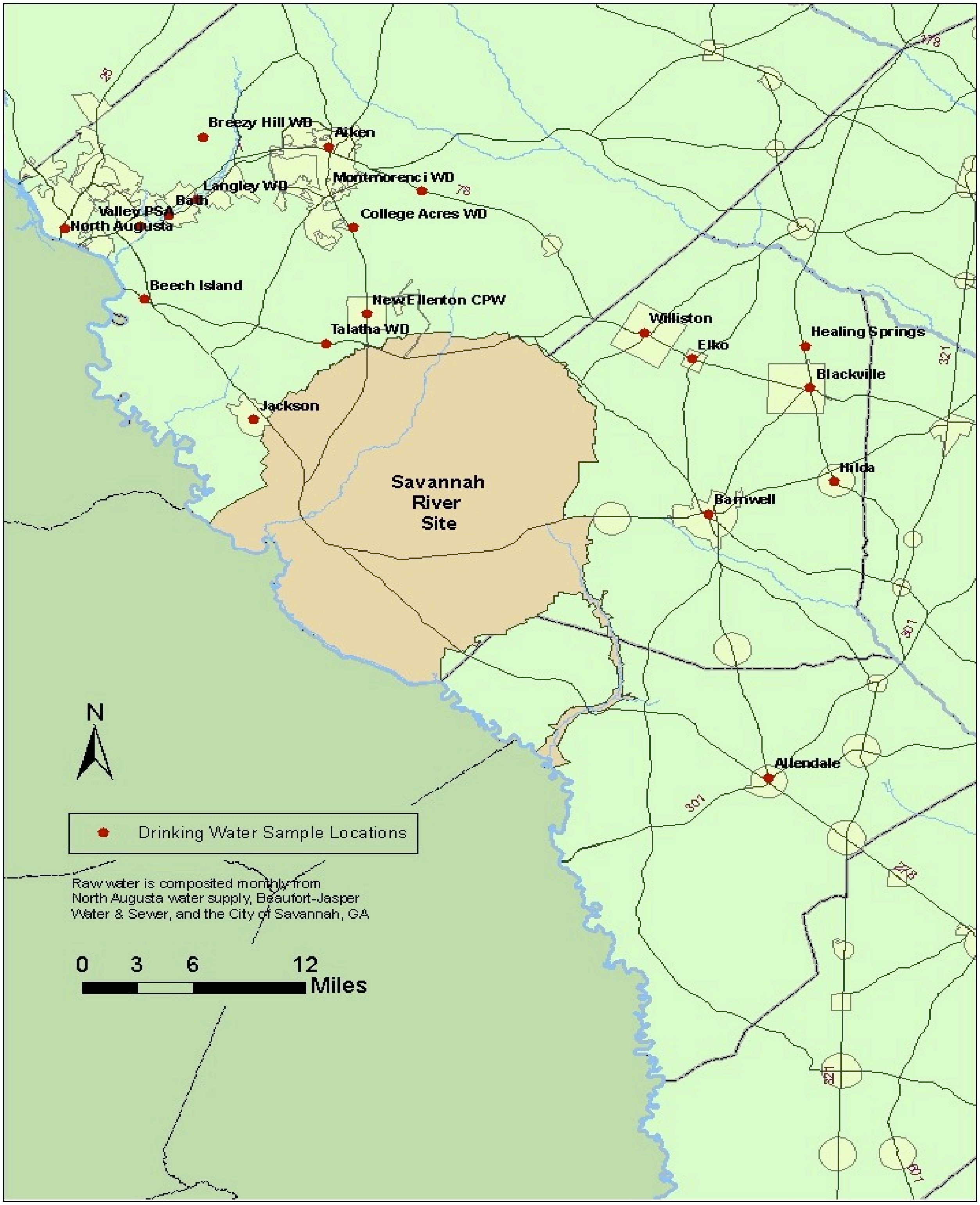
## 2.2.2
## Map 4. Drinking Water Monitoring Locations

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## 2.2.3 Tables and Figures
## Drinking Water Quality Monitoring

**Table 1. Drinking Water Systems Sampled by ESOP**

| System Number | System Name | Number of Taps | Population Served |
|---|---|---|---|
| **210001** | Aiken | 17,657 | 40,498 |
| **210002** | Jackson | 1,296 | 3,602 |
| **210007** | New Ellenton | 2,121 | 5,303 |
| **220001** | Langley Water District | 335 | 838 |
| **220002** | College Acres Public Water District | 527 | 1,350 |
| **220003** | Bath Water District | 314 | 1,064 |
| **220004** | Beech Island | 2,983 | 7,436 |
| **220005** | Talatha Water District | 568 | 1,553 |
| **220006** | Breezy Hill Water District | 4,899 | 15,886 |
| **220008** | Montmorenci Water District | 1,237 | 3,082 |
| **220012** | Valley Public Service Authority | 3,323 | 6,818 |
| **310001** | Allendale | 1,486 | 4,052 |
| **610001** | Barnwell | 2,494 | 6,727 |
| **610002** | Williston | 1,612 | 3,307 |
| **610003** | Blackville | 1,068 | 2,973 |
| **610004** | Hilda | 131 | 466 |
| **610005** | Elko | 150 | 462 |
| **0210003F** | North Augusta Surface Water | 10,305 | 26,388 |
| **0720003F** | Chelsea B/J Plant Surface Water canal intake | 40,714 | 131,846 |
| **0720004F** | Purrysburg B/J Plant Surface Water SR intake | | |
| **SAVF** | City of Savannah Surface Water (Industrial) | 35 | 10,619 |
| | **TOTAL** | 93,255 | 274,270 |
| | Approx. Groundwater | 42,201 | 105,417 |
| | Approx. Surface water | 51,054 | 168,853 |

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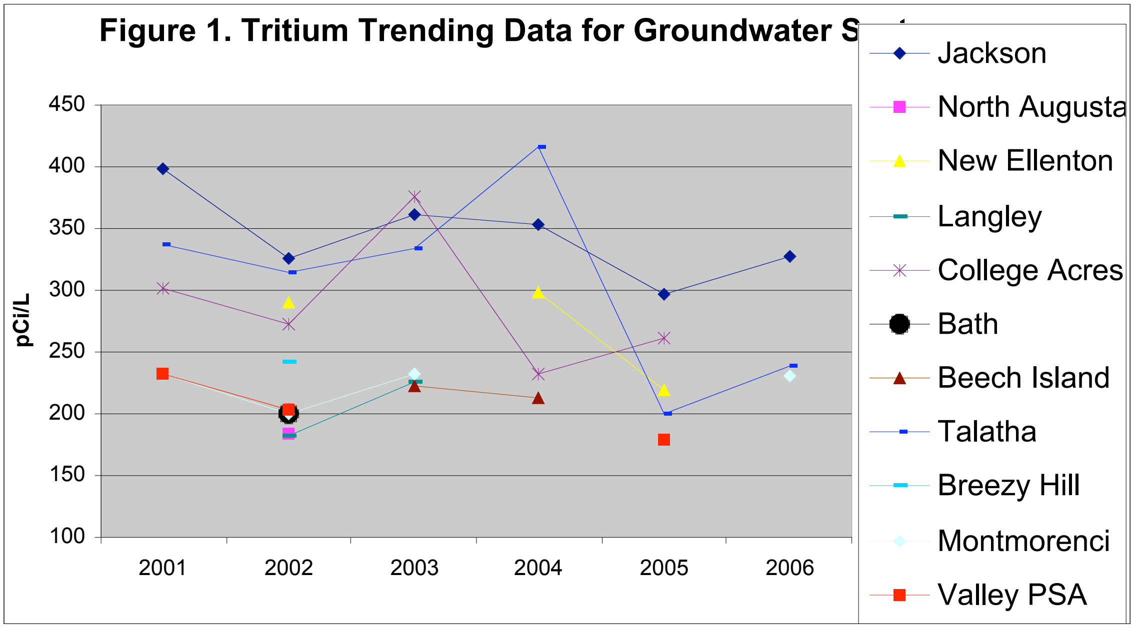
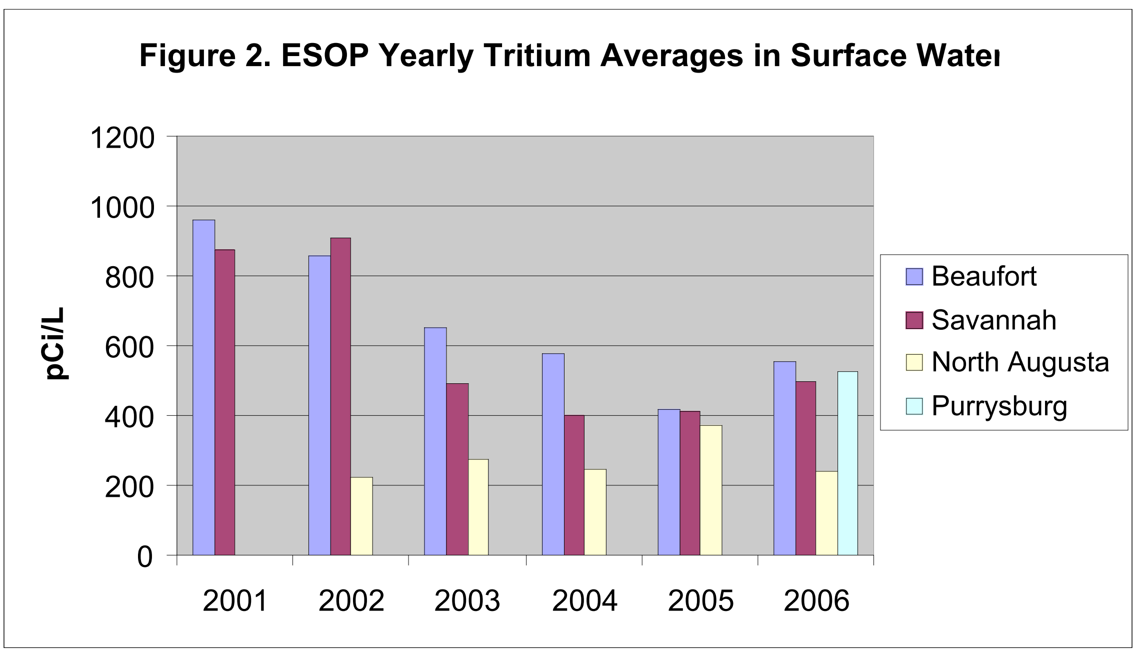
## Tables and Figures
## Drinking Water Quality Monitoring

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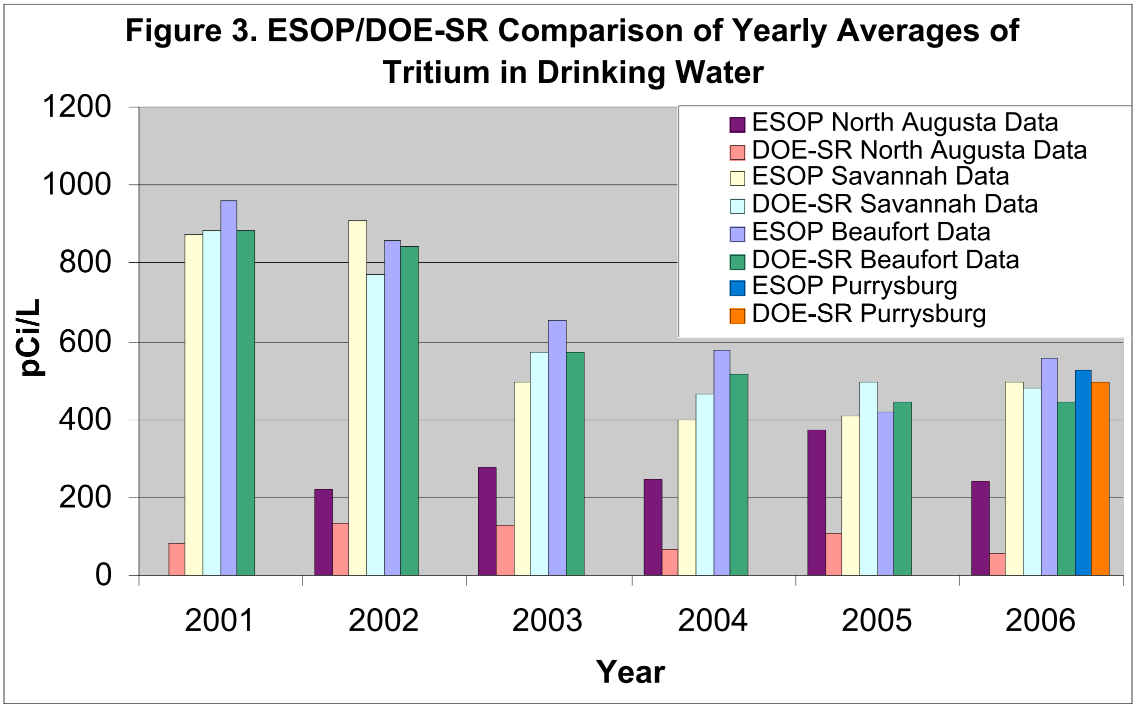
## Tables and Figures
## Drinking Water Quality Monitoring

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### 2.2.4 Data
### Drinking Water Quality Monitoring Data



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## Drinking Water Quality Monitoring
## Groundwater Systems

| System Number: | | | DW0210001 | | DW0210002 | |
|---|---|---|---|---|---|---|
| Date: | | | April-06 | Oct.-06 | July-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.02 | <1.97 | 3.20 | 4.19 |
| | ±2 | (sigma) | | | 1.45 | 1.5 |
| | N-V Beta | (pCi/L) | <2.84 | 3.01 | <2.54 | <2.61 |
| | ±2 | (sigma) | | 1.37 | | |
| | Tritium | (pCi/L) | <188 | <196 | <184 | 327 |
| | ±2 | (sigma) | | | | 96 |
| | Cesium-137 | (pCi/L) | <3.986 | <3.809 | <3.354 | <3.313 |
| | ±2 | (sigma) | | | | |

| System Number: | | | DW0210003 | | DW0210007 | |
|---|---|---|---|---|---|---|
| Date: | | | April-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.89 | <1.94 | <1.74 | 1.95 |
| | ±2 | (sigma) | | | | 1.12 |
| | N-V Beta | (pCi/L) | <2.83 | <2.27 | <2.82 | 2.82 |
| | ±2 | (sigma) | | | | 1.5 |
| | Tritium | (pCi/L) | <189 | <196 | <189 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.345 | <3.965 | <3.354 | <3.439 |
| | ±2 | (sigma) | | | | |

| System Number: | | | DW0220001 | | DW0220002 | |
|---|---|---|---|---|---|---|
| Date: | | | April-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.72 | 2.37 | <2.03 | 4.1 |
| | ±2 | (sigma) | | 1.27 | | 1.49 |
| | N-V Beta | (pCi/L) | <2.82 | <2.27 | <2.84 | <2.61 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <188 | <196 | <189 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.987 | <3.987 | <3.464 | <3.478 |
| | ±2 | (sigma) | | | | |

**Back to List of Data tables** **Back to 2.2.4 Drinking Water Data**

## Drinking Water Quality Monitoring
## Groundwater Systems

| System Number: | | | DW0220003 | | DW0220004 | |
|---|---|---|---|---|---|---|
| Date: | | | April-06 | Oct.-06 | July-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.17 | <2.09 | <1.86 | <1.74 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <2.85 | <2.28 | <2.53 | <2.61 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <189 | <196 | <184 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.580 | <3.999 | <3.254 | <3.388 |
| | ±2 | (sigma) | | | | |

| System Number: | | | DW0220005 | | DW0220006 | |
|---|---|---|---|---|---|---|
| Date: | | | July-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.90 | <1.80 | <1.94 | <1.95 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | 2.65 | <2.61 | <2.83 | 3.01 |
| | ±2 | (sigma) | 1.46 | | | 1.37 |
| | Tritium | (pCi/L) | 224 | 253 | <188 | <196 |
| | ±2 | (sigma) | 87 | 93 | | |
| | Cesium-137 | (pCi/L) | <3.386 | <3.505 | <4.000 | <3.977 |
| | ±2 | (sigma) | | | | |

| System Number: | | | DW0220008 | | DW0220012 | |
|---|---|---|---|---|---|---|
| Date: | | | April-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.95 | <1.79 | <3.68 | 5.7 |
| | ±2 | (sigma) | | | | 2.07 |
| | N-V Beta | (pCi/L) | <2.83 | <2.61 | <2.92 | 3.74 |
| | ±2 | (sigma) | | | | 1.46 |
| | Tritium | (pCi/L) | 257 | 205 | <189 | <196 |
| | ±2 | (sigma) | 90 | 91 | | |
| | Cesium-137 | (pCi/L) | <3.453 | <3.404 | <3.486 | <3.843 |
| | ±2 | (sigma) | | | | |

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## Drinking Water Quality Monitoring
## Groundwater Systems

| System Number: | | | **DW0310001** | | **DW0610001** | |
|---|---|---|---|---|---|---|
| Date: | | | July-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.86 | <2.65 | <2.26 | <2.04 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <2.60 | 2.57 | <2.85 | <2.63 |
| | ±2 | (sigma) | | 1.36 | | |
| | Tritium | (pCi/L) | <184 | <196 | <189 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.546 | <3.979 | <3.582 | <3.547 |
| | ±2 | (sigma) | | | | |

| System Number: | | | **DW0610002** | | **DW0610003** | |
|---|---|---|---|---|---|---|
| Date: | | | July-06 | Oct.-06 | July-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | 6.06 | 1.82 | <2.59 | <2.35 |
| | ±2 | (sigma) | 1.65 | 1.15 | | |
| | N-V Beta | (pCi/L) | 4.91 | <2.60 | <2.58 | <2.65 |
| | ±2 | (sigma) | 1.62 | | | |
| | Tritium | (pCi/L) | <184 | <196 | <184 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.513 | <3.474 | <3.295 | <3.357 |
| | ±2 | (sigma) | | | | |

| System Number: | | | **DW0610004** | | **DW0610005** | |
|---|---|---|---|---|---|---|
| Date: | | | July-06 | Oct.-06 | April-06 | Oct.-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.19 | <1.93 | <2.73 | <2.02 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <2.55 | <2.62 | <2.88 | <2.63 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <184 | <196 | <189 | <196 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.311 | <3.155 | <3.359 | <3.322 |
| | ±2 | (sigma) | | | | |

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## Drinking Water Quality Monitoring
## Surface Water

| | | | | | | |
|---|---|---|---|---|---|---|
| Sample Number: | | | **DW0210003R** | **DW0210003R** | **DW0210003R** | **DW0210003R** |
| Date: | | | January-06 | February-06 | March-06 | April-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.39 | <2.53 | <2.52 | <1.62 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <3.05 | <3.04 | <3.04 | <2.52 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <187 | <196 | <196 | <180 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <2.179 | <3.394 | <3.554 | <3.497 |
| | ±2 | (sigma) | | | | |
| Sample Number: | | | **DW0210003R** | **DW0210003F** | **DW0210003F** | **DW0210003F** |
| Date: | | | May-06 | June-06 | July-06 | August-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.61 | <2.22 | <2.21 | <1.98 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <2.52 | <2.78 | <2.78 | <3.01 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <180 | <191 | <191 | <197 |
| | ±2 | (sigma) | | | | |
| | Cesium-137 | (pCi/L) | <3.933 | <3.330 | <3.220 | <3.067 |
| | ±2 | (sigma) | | | | |
| Sample Number: | | | **DW0210003F** | **DW0210003F** | **DW0210003F** | **DW0210003F** |
| Date: | | | September-06 | October-06 | November-06 | December-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.85 | <1.54 | <1.47 | <2.29 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <3.00 | <2.89 | <3.85 | <3.77 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | <197 | 241 | <188 | <182 |
| | ±2 | (sigma) | | 89 | | |
| | Cesium-137 | (pCi/L) | <3.429 | <3.265 | <3.393 | <3.444 |
| | ±2 | (sigma) | | | | |

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## Drinking Water Quality Monitoring
## Surface Water

| Sample Number: | DW0720003R | | **DW0720003R** | **DW0720003R** | **DW0720003R** | **DW0720003R** |
|---|---|---|---|---|---|---|
| Date: | | | January-06 | February-06 | March-06 | April-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.68 | <2.89 | <3.11 | <1.97 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <3.07 | <3.06 | <3.07 | <2.54 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | 555 | 439 | 465 | 556 |
| | ±2 | (sigma) | 102 | 101 | 102 | 99 |
| | Cesium-137 | (pCi/L) | <1.812 | <3.605 | <3.237 | <3.779 |
| | ±2 | (sigma) | | | | |
| Sample Number: | **DW0720003R** | | **DW0720003R** | **DW0720003F** | **DW0720003F** | **DW0720003F** |
| Date: | | | May-06 | June-06 | July-06 | August-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.12 | <2.38 | <2.02 | <1.83 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <2.55 | <2.79 | <3.02 | 3.47 |
| | ±2 | (sigma) | | | | 1.71 |
| | Tritium | (pCi/L) | 1055 | 389 | 385 | 391 |
| | ±2 | (sigma) | 117 | 96 | 99 | 99 |
| | Cesium-137 | (pCi/L) | <3.734 | <3.516 | <3.468 | <3.379 |
| | ±2 | (sigma) | | | | |
| Sample Number: | **DW0720003R** | | **DW0720003F** | **DW0720003F** | **DW0720003F** | **DW0720003F** |
| Date: | | | September-06 | October-06 | November-06 | December-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.05 | <1.71 | <1.68 | <2.59 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <3.02 | <2.90 | <3.88 | <3.80 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | 562 | 1072 | 434 | 357 |
| | ±2 | (sigma) | 105 | 120 | 98 | 92 |
| | Cesium-137 | (pCi/L) | <3.187 | <3.551 | <3.500 | <3.933 |
| | ±2 | (sigma) | | | | |

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## Drinking Water Quality Monitoring
## Surface Water

| Sample Number: | DWSAVR | | DWSAVR | DWSAVR | DWSAVR | DWSAVR |
|---|---|---|---|---|---|---|
| Date: | | | January-06 | February-06 | March-06 | April-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.63 | NS | <2.66 | <1.81 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | <3.06 | NS | <3.96 | <2.53 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | 415 | NS | 509 | 505 |
| | ±2 | (sigma) | 97 | | 104 | 98 |
| | Cesium-137 | (pCi/L) | <2.00 | NS | <3.672 | <3.566 |
| | ±2 | (sigma) | | | | |
| Sample Number: | DWSAVR | | DWSAVR | DWSAVR | DWSAVR | DWSAVF |
| Date: | | | May-06 | June-06 | July-06 | August-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | NS | <2.34 | <1.95 | <2.03 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | NS | <2.79 | <3.01 | <3.02 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | NS | 656 | 236 | 294 |
| | ±2 | (sigma) | | 106 | 93 | 95 |
| | Cesium-137 | (pCi/L) | NS | <3.526 | <3.538 | <3.421 |
| | ±2 | (sigma) | | | | |
| Sample Number: | DWSAVR | | DWSAVF | DWSAVF | DWSAVF | DWSAVF |
| Date: | | | September-06 | October-06 | November-06 | December-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <2.10 | <1.72 | <2.59 | <2.56 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | 3.96 | <2.91 | <3.80 | <3.80 |
| | ±2 | (sigma) | 1.76 | | | |
| | Tritium | (pCi/L) | 1088 | 585 | 216 | 469 |
| | ±2 | (sigma) | 123 | 103 | 86 | 96 |
| | Cesium-137 | (pCi/L) | <3.381 | <3.327 | <3.516 | <3.416 |
| | ±2 | (sigma) | | | | |

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## Drinking Water Quality Monitoring
## Surface Water

| Sample Number: | **DW0720004R** | | **DW0720004R** | **DW0720004R** | **DW0720004R** | **DW0720004R** |
|---|---|---|---|---|---|---|
| Date: | | | January-06 | February-06 | March-06 | April-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | NS | NS | <2.70 | <1.81 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | NS | NS | <3.05 | <2.53 |
| | ±2 | (sigma) | | | | |
| | Tritium | (pCi/L) | NS | NS | | 455 |
| | ±2 | (sigma) | | | | 95 |
| | Cesium-137 | (pCi/L) | NS | NS | <3.351 | <3.730 |
| | ±2 | (sigma) | | | | |
| Sample Number: | **DW0720004R** | | **DW0720004R** | **DW0720004R** | **DW0720004R** | **DW0720004R** |
| Date: | | | May-06 | June-06 | July-06 | August-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.77 | <2.29 | <1.91 | <1.93 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | 2.99 | <2.78 | 3.61 | <3.01 |
| | ±2 | (sigma) | 1.47 | | 1.73 | |
| | Tritium | (pCi/L) | 461 | 548 | 378 | 420 |
| | ±2 | (sigma) | 96 | 103 | 98 | 100 |
| | Cesium-137 | (pCi/L) | <3.761 | <3.443 | <3.349 | <3.560 |
| | ±2 | (sigma) | | | | |
| Sample Number: | **DW0720004R** | | **DW0720004F** | **DW0720004F** | **DW0720004F** | **DW0720004F** |
| Date: | | | September-06 | October-06 | November-06 | December-06 |
| **Radionuclides** | Gross Alpha | (pCi/L) | <1.98 | <1.67 | <1.65 | <2.59 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/L) | 3.07 | <2.90 | <3.87 | <3.80 |
| | ±2 | (sigma) | 1.7 | | | |
| | Tritium | (pCi/L) | 631 | 950 | 467 | 436 |
| | ±2 | (sigma) | 108 | 116 | 99 | 95 |
| | Cesium-137 | (pCi/L) | <3.514 | <3.354 | <3.151 | <3.347 |
| | ±2 | (sigma) | | | | |

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## 2.2.5 Summary Statistics
## Drinking Water Quality Monitoring

### Ground Water

Radionuclide: Gross Alpha (pCi/L)

| Statistical Analysis: | | Median | Avg. | St. Dev. | Max | Min | Num | Skew |
|---|---|---|---|---|---|---|---|---|
| System Number: | **DW0210002** | 3.70 | 3.70 | 0.70 | 4.19 | 3.20 | 2 | 0 |
| | **DW0210007** | 1.95 | 1.95 | 0 | 1.95 | 1.95 | 1 | 0 |
| | **DW0220002** | 4.10 | 4.1 | 0 | 4.1 | 4.1 | 1 | 0 |
| | **DW0220012** | 5.70 | 5.7 | 0 | 5.7 | 5.7 | 1 | 0 |
| | **DW0610002** | 3.94 | 3.94 | 3.00 | 6.06 | 1.82 | 2 | 0 |
| | **DW0220001** | 2.37 | 2.37 | 0 | 2.37 | 2.37 | 1 | 0 |
| yearly avg. of detectable gross alpha | | | 3.63 | | | | | |
| standard deviation | | | 1.34 | | | | | |

Radionuclide: Gross Non-volatile Beta (pCi/L)

| Statistical Analysis: | | Median | Avg. | St. Dev. | Max | Min | Num | Skew |
|---|---|---|---|---|---|---|---|---|
| System Number: | **DW0210007** | 2.82 | 2.82 | 0 | 2.82 | 2.82 | 1 | 0 |
| | **DW0220006** | 3.01 | 3.01 | 0 | 3.01 | 3.01 | 1 | 0 |
| | **DW0220012** | 3.74 | 3.74 | 0 | 3.74 | 3.74 | 1 | 0 |
| | **DW0210001** | 3.01 | 3.01 | 0 | 3.01 | 3.01 | 1 | 0 |
| | **DW0310001** | 2.57 | 2.57 | 0 | 2.57 | 2.57 | 1 | 0 |
| | **DW0610002** | 4.91 | 4.91 | 0 | 4.91 | 4.91 | 1 | 0 |
| | **DW0220005** | 2.65 | 2.65 | 0 | 2.65 | 2.65 | 1 | 0 |
| yearly avg. of detectable non-volatile beta | | | 3.24 | | | | | |
| standard deviation | | | 0.83 | | | | | |

Radionuclide: Tritium (pCi/L)

| Statistical Analysis: | | Median | Avg. | St. Dev. | Max | Min | Num | Skew |
|---|---|---|---|---|---|---|---|---|
| System Number: | **DW0210002** | 327 | 327 | 0.00 | 327 | 327.00 | 1 | 0 |
| | **DW0220005** | 238.50 | 238.50 | 20.51 | 253 | 224 | 2 | 0 |
| | **DW0220008** | 231 | 231 | 36.77 | 257 | 205 | 2 | 0 |
| yearly avg. of detectable tritium | | | 265.50 | | | | | |
| standard deviation | | | 53.39 | | | | | |

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## Summary Statistics
## Drinking Water Quality Monitoring

### Surface Water

| Radionuclide: | | Gross Non-volatile Beta (pCi/L) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Statistical Analysis: | | **Median** | **Avg.** | **St. Dev.** | **Max** | **Min** | **Num** | **Skew** |
| System Number: | **DW0210003R/F** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **DW0720003R/F** | 3.47 | 3.470 | 0.000 | 3.47 | 3.47 | 1 | 0 |
| | **DW0720004R/F** | 3.07 | 3.223 | 0.337 | 3.61 | 2.99 | 3 | 1.62305 |
| | **DWSAVR/F** | 3.96 | 3.96 | 0 | 3.96 | 3.96 | 1 | 0 |
| yearly mean of detectable gross alpha | | | 3.551 | | | | | |
| standard deviation | | | 0.375 | | | | | |

| Radionuclide: | | Tritium (pCi/L) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Statistical Analysis: | | **Median** | **Avg.** | **St. Dev.** | **Max** | **Min** | **Num** | **Skew** |
| System Number: | **DW0210003R/F** | 241 | 241.00 | 0.00 | 241 | 241 | 1 | 0 |
| | **DW0720003R/F** | 452 | 555.00 | 247.92 | 1072 | 357 | 12 | 1.700 |
| | **DW0720004R/F** | 461 | 527.33 | 175.09 | 950 | 378 | 9 | 2.108 |
| | **DWSAVR/F** | 487 | 497.30 | 253.49 | 1088 | 216 | 10 | 1.379 |
| yearly mean of detectable tritium | | | 455.16 | | | | | |
| standard deviation | | | 144.70 | | | | | |

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## 2.3 Radiological Monitoring of Surface Water

### 2.3.1 Summary

Surface water bodies on and adjacent to the Savannah River Site (SRS) continue to be the focus for monitoring and surveillance activities of the Radiological Monitoring of Surface Water (RSW) project that is part of the Environmental Surveillance and Oversight Program (ESOP). Surface water samples were collected and analyzed for radionuclides and the results were compared to Department of Energy-Savannah River (DOE-SR) data. In addition, project databases were expanded and data trends for radionuclides in streams were given. These activities will allow the project to generate independent data that can be shared with the public.

The RSW Project continues to collect surface water samples from 14 specific locations within and outside of the SRS as part of an "ambient" sampling network (Map 5, section 2.3.2). At some locations, samples are collected three days per week as part of an "enhanced" sampling protocol. Depending on location and frequency, samples are analyzed for tritium, gross alpha, gross beta and gamma-emitting radionuclides. Additionally, supplemental surface water samples are collected weekly from five other locations. These samples are collected for the purpose of monitoring any potential releases from F, H and Z-areas.

The enhanced surface water monitoring program is intended to provide downstream drinking water customers with advance notice of the potential for increased tritium levels in the Savannah River as the result of an SRS release. This early detection facet is possible because of the continuous monitoring of six SRS streams that flow to the Savannah River. In 2006, samples were analyzed for tritium on the day of collection and results from the tritium analysis were used to project tritium activity in the Savannah River. There were no releases via SRS streams above expected activities, and tritium at Hwy. 301 (SV-118) did not exceed the Environmental Protection Agency's Maximum Contaminant Level for drinking water.

The RSW Project will continue to collect and analyze surface water on and adjacent to the SRS. This monitoring effort will provide an improved understanding of radionuclide levels in SRS surface waters and valuable information relative to human health exposure pathways.

**RESULTS AND DISCUSSION**

**Surface Water**

A summary of surface water data for each location is located in section 2.3.4.

Tritium

Samples from SRS streams and the Savannah River were analyzed for tritium activity. Four Mile Creek receives effluent from F-Area, H-Area, and the Central Sanitary Wastewater Treatment Facility (CSWTF); stormwater runoff from E-Area, C-Area, F-Area, and H-Area; and leachate from seepage basins and the Old Radioactive Waste Burial Ground (ORWBG) (WSRC 2001b). Pen Branch receives discharges and stormwater runoff from K-Area. Most of the tritium in Pen Branch is attributed to groundwater seepage from K-Area. Upper Three Runs

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receives discharges from the Effluent Treatment Facility (ETF), which has treated low-level radioactive wastewater since 1994. Stormwater runoff from F-Area, H-Area, S-Area, and Z-Area also impact Upper Three Runs by transferring contamination to waterways of the state (WSRC 2001b). In addition, groundwater that has migrated from E-Area outcrops into Upper Three Runs (ORWBG FG 2001).

Tritium activity was detected at all sample locations where weekly samples were collected. Four Mile Creek and Pen Branch continue to yield the highest levels of tritium activity (Table 1, section 2.3.3). Tritium activity ranged from 180 pCi/L (Little Hell Landing) to 305,742 pCi/L (Four Mile Creek, SV-2045). The average tritium activity at all sampling sites was reported without subtracting background values.

Tritium activity in the Savannah River at the confluences of the five SRS streams was scheduled for monitoring on a quarterly basis (Boat Run Data, section 2.3.4). Three samples were collected each time at Four Mile Creek (SV-2015), one from the creek mouth, one from 30 feet downstream of the creek mouth, and one from 150 feet downstream of the creek mouth. Samples were taken at these three intervals in order to show the effect of the mixing zone created by the Savannah River flow. Samples from this location had the highest average tritium activity of all creek mouth locations (70,374 pCi/L at the creek mouth).

Tritium was detected in only one random sample, collected from Lexington County (Random Sample Data, section 2.3.4,).

Average tritium activity in upstream background locations (Jackson Boat Landing and Upper Three Runs) was lower than average tritium activity at the enhanced and ambient sample locations. Four Mile Creek (SV-2039) and Pen Branch (SV-2047) continued to have the highest levels of tritium activity. Four Mile Creek receives effluent from F-Area, H-Area, and the CSWTF; stormwater runoff from E-Area, C-Area, F-Area, and H-Area; and leachate from seepage basins and the ORWBG (WSRC 2001b). However, since the beginning of the phytoremediation project at Four Mile Creek, tritium levels have decreased. Scheduled maintenance activity of the phytoremediation pond resulted in a discharge to Four Mile Creek that temporarily elevated tritium levels in Four Mile Creek. Pen Branch receives discharges and stormwater runoff from K-Area. Most of the tritium in Pen Branch is attributed to groundwater seepage (WSRC 2001b). Due to historical and current activities in these areas, these streams will continue to exhibit higher activities of tritium in relation to other sample locations. Upper Three Runs (SV-325) continues to display high variation in tritium activity. This is a consequence of receiving batch discharges from the ETF upstream of this location. ETF treats wastewater with low levels of radioactive contaminants (WSRC 2000).

Cesium-137

Cesium-137 (Cs-137) was detected only in four surface water samples collected from one location within the supplemental monitoring program. Samples collected from Four Mile Creek (SV-2045) had activities ranging from 5.08 (±2.42) pCi/L to 11.41 (±4.00) pCi/L (Table 2, section 2.2.3). All other sampling locations were below detection.

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Gross Alpha

Alpha-emitting radionuclide activity was detected at eight of the nine locations where monthly composite samples were collected, with Jackson Boat Landing (SV-2010) being the exception (Table 3, section 2.3.3). Activity ranged from 0.74 pCi/L to 10.70 pCi/L, with the highest value at Upper Three Runs (SV-325).

A review of the average annual gross alpha data for the period from 2001-2006 revealed variability with no apparent upward or downward trending (Figure 1, section 2.3.3). The results ranged from 1.14 pCi/L (Lower Three Runs, 2003 and 2005) to 6.06 pCi/L (Upper Three Runs, 2006), without subtracting background (Jackson Landing) activity values. All analytical results were below the EPA MCL of 15 pCi/L for drinking water (U.S. EPA 2002).

Gross Beta

Beta-emitting radionuclide activity was detected in all nine locations where monthly composite samples were collected (Table 4, section 2.3.3). The activity ranged from 2.28 pCi/L to 8.70 pCi/L, with Highway 301 recording the highest activity. There was only one detection of beta activity at the Steel Creek ESOP sampling location.

Upward or downward trends are not readily apparent for the annual average gross beta data for 2001-2006 (Figure 2, section 2.3.3). Activity levels were reported ranging from 1.99 pCi/L (Upper Three Runs, 2003) to 6.67 pCi/L (Highway 301, 2006), without subtracting background (Jackson Landing) activity. All analytical results were below the EPA MCL of 8 pCi/L for drinking water (U.S. EPA 2002).

**ESOP/DOE-SR DATA COMPARISON**

Data from 2006 reported in this project was compared to DOE-SR reported results (WSRC 2007). ESOP and DOE-SR collocated sampling sites were Upper Three Runs, Four Mile Creek, Pen Branch, Steel Creek, Steel Creek Landing, Lower Three Runs, and Highway 301 Bridge.

Tritium

DOE-SR average tritium activities for colocated sites were within one standard deviation (SD) of ESOP average tritium activities at Upper Three Runs, Four Mile Creek, Pen Branch, Steel Creek, Steel Creek Boat Landing, and Highway 301 Bridge (Table 1, section 2.3.3). DOE-SR tritium activity at Lower Three Runs was greater than three SDs of the ESOP tritium activity. The 2006 ESOP and DOE-SR tritium results appear to be consistent with historically reported data values (section 2.3.3, Figures 3-8) (SCDHEC 2000 - 2006, WSRC 2000-2007).

Cesium-137

ESOP detected Cs-137 activity only at the Four Mile Creek, SV-2045 location (7.65 (±3.02) pCi/L, Table 2, section 2.3.3). All ESOP samples from colocated sample locations were below detection. DOE-SR reported Cs-137 at all collocated sample locations, with the highest average value found at Four Mile Creek (1.53 (±0.67) pCi/L) (WSRC 2007). Since ESOP did not detect

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Cs-137 at any collocated stations with DOE-SR, no comparison was made.

Gross Alpha

ESOP detected gross alpha activity at all of the colocated sample locations (Table 3, section 2.3.3). DOE-SR average gross alpha activities were within one SD of ESOP average gross alpha activities at Upper Three Runs, Four Mile Creek, Pen Branch, and Lower Three Runs. Additionally, DOE-SR average gross alpha activities were within two SDs of ESOP gross alpha at Steel Creek and Highway 301 Bridge. ESOP samples and DOE-SR samples at Upper Three Runs exhibited the highest alpha (6.06 (±3.00) pCi/L and 8.50 (±0.23), respectively) (WSRC 2007).

Gross Beta

ESOP detected gross beta activity at all of the colocated sampling locations (Table 4, section 2.3.3) and showed the highest variability compared to DOE-SR samples. DOE-SR average gross beta activities were within one SD of ESOP average gross alpha activities only at Upper Three Runs. DOE-SR gross beta activities from Pen Branch, Lower Three Runs, and Highway 301 Bridge were within two SDs of ESOP gross beta activities. DOE-SR gross beta activities from Four Mile Creek were within three SDs of ESOP gross beta activities. The highest levels of ESOP beta-emitting radionuclide activity were detected in samples collected from the Four Mile Creek SV-2045 location (14.13 (±3.89) pCi/L). The highest DOE-SR gross beta activities were in samples collected from Four Mile Creek (9.46 (±0.18) (WSRC 2007). These levels may be related to the groundwater contamination from the ORWBG and the former seepage basins located in F-Area and H-Area (WSRC 2000) and discharge from the phyto-remediation pond.

ESOP utilizes MDA in reporting radioactivity and does not report anything below MDA. DOE-SR, however, incorporates all values, including negative numbers (those values below the minimum detection limit). This approach accounts for seemingly large differences between average values. Also, differences could be attributed, in part, to the nature of the water medium and the specific point and time when the sample was collected.

## CONCLUSIONS AND RECOMMENDATIONS

All tritium results for the public access locations downstream from SRS were below the EPA MCL of 20,000 pCi/L for drinking water. However, data generated from samples collected at the mouth of Four Mile Creek indicate that the public could come into contact with tritium activity greater than the MCL at that location.

Differences in analytical results for tritium activity at sampling sites colocated with DOE-SR ranged from one SD to greater than three SDs. Also, a comparison of gross alpha and beta data identified results within one to two SDs and one to three SDs, respectively. ESOP typically detects gross alpha emitting radionuclides from samples collected from the Upper Three Runs location (SV-325). Furthermore, DOE-SR samples yield alpha detections from this same location. These alpha detects are most likely attributed to past activities from facilities upstream of this sampling location. In 2006, ESOP samples yielded two gross beta detects at the US Highway 301 sampling location (SV-118). The highest of these was 8.70 pCi/L, with an average

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of 6.67 pCi/L. Comparing this SV-118 average to the 2006 background location average of 2.47 pCi/L at Jackson Boat Landing (SV-2010) would indicate that the gross beta detection potentially came from SRS. During the period of 2001-2005, ESOP did detect gross beta at this location. Samples collected in 2003 showed six detections with the highest detection at 3.99 pCi/L. With the exception of 2003, the average number of gross beta detections for 2001-2005 at this location is two. This low number of detects for gross beta may be attributed to fallout from past nuclear activities not related to SRS.

ESOP will continue independent monitoring of surface water and will periodically evaluate modifications of the monitoring activities to better accomplish the project's goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide activity in SRS surface waters and the Savannah River, and impart valuable information to human health exposure pathways. This comparison of data results allows for independent data verification of DOE-SR monitoring activities.

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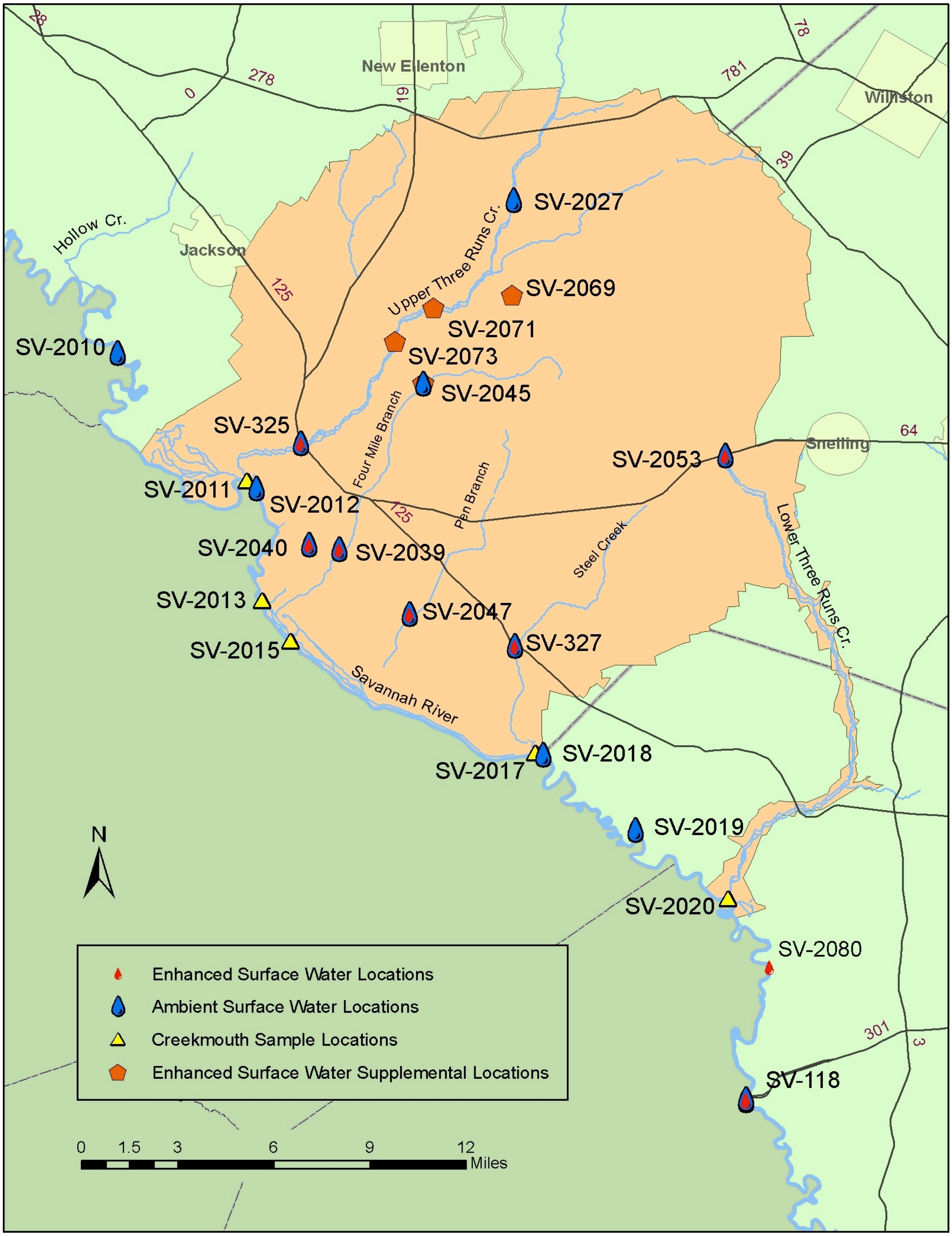
## 2.3.2
## Map 5. Radiological Monitoring of Surface Water Sample Locations

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## 2.3.3 Tables and Figures
## Radiological Monitoring of Surface Water

Table 1. Surface Water Tritium Detection Data

| Sample Location | Avg. Conc. (pCi/L) | SD | Min. Conc. (pCi/L) | Max. Conc. (pCi/L) | # of Samples | # of Detects |
|---|---|---|---|---|---|---|
| Jackson Landing (SV-2010) | 205 | 16 | 187 | 286 | 52 | 6 |
| Upper Three Runs (SV-2027) | 264 | 59 | 191 | 496 | 52 | 36 |
| ***Upper Three Runs (SV-325)*** | 1,291 | 665 | 466 | 4,414 | 52 | 52 |
| ***U3R-4 at Road A**** | 1,560 | 85 | 954 | 2,490 | 12 | NR |
| Upper Three Runs (SV-2011) Creek Mouth | 510 | 50 | 465 | 580 | 4 | 4 |
| TNX Boat Landing (SV-2012) | 252 | 54 | 197 | 436 | 52 | 21 |
| Beaver Dam Creek (SV-2040) | 286 | 71 | 184 | 537 | 52 | 35 |
| Beaver Dam Creek (SV-2013) Creek Mouth | 215 | 32 | 192 | 237 | 4 | 2 |
| ***Four Mile Creek (SV-2039)*** | 73,286 | 23,614 | 47,977 | 123,518 | 52 | 52 |
| ***FM-6 Road A-12.2**** | 77,700 | 279 | 52,200 | 129,000 | 12 | NR |
| Four Mile Creek (SV-2045) | 181,078 | 60,367 | 19,818 | 305,742 | 52 | 52 |
| Four Mile Creek (SV-2015) Creek Mouth | 70,374 | 18,822 | 59,042 | 98,505 | 4 | 4 |
| Four Mile Creek (SV-2015) 30' downstream from creek mouth | 40,063 | 19,491 | 21,486 | 58,902 | 4 | 4 |
| Four Mile Creek (SV-2015) 150' downstream from creek mouth | 29,593 | 19,726 | 15,294 | 58,206 | 4 | 4 |
| ***Pen Branch (SV-2047)*** | 48,747 | 12,354 | 20,114 | 69,738 | 52 | 52 |
| ***PB-3 at Road 13.2**** | 50,200 | 230 | 33,800 | 68,600 | 12 | NR |
| ***Steel Creek (SV-327)*** | 2,832 | 621 | 1,800 | 4,338 | 52 | 52 |
| ***SC-4 Steel Creek at Road A**** | 3,100 | 92 | 1,780 | 4,490 | 12 | NR |
| Steel Creek (SV-2017) Creek Mouth | 5,213 | 3,669 | 1,780 | 10,335 | 4 | 4 |
| ***Steel Creek Boat Landing (SV-2018)*** | 1,000 | 2,008 | 200 | 9,976 | 52 | 45 |
| ***Steel Creek Boat Ramp River Mile 141.5*** | 660 | 14 | 79 | 2,840 | 52 | NR |
| ***Lower Three Runs (SV-2053)*** | 410 | 71 | 288 | 596 | 52 | 52 |
| ***L3R-1A at Road B**** | 645 | 78 | 152 | 1,170 | 12 | NR |
| Lower Three Runs (SV-2020) Creek Mouth | 1,181 | 669 | 645 | 2,117 | 4 | 4 |
| Little Hell Landing (SV-2019) | 524 | 370 | 180 | 1,944 | 52 | 45 |
| ***Highway 301 Bridge (SV-118)*** | 605 | 448 | 187 | 2,498 | 52 | 52 |
| ***River Mile 118.8**** | 645 | 13 | 185 | 1,990 | 52 | NR |

Notes:
(1) *WSRC data from the SRS Environmental Data Report for 2006
(2) Bold and italicized entries represent colocated sampling stations.
(3) NR: Not Reported
(4) Conc. = Concentration
(5) SD=Standard Deviation

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## Tables and Figures
## Radiological Monitoring of Surface Water

Table 2. Surface Water Cs-137 Detection Data

| Sample Location | Ave. Conc. (pCi/L) | SD | Min. Conc. (pCi/L) | Max. Conc. (pCi/L) | # of Samples | # of Detects |
|---|---|---|---|---|---|---|
| Jackson Landing (SV-2010) | ND | ND | ND | ND | 12 | 0 |
| ***Upper Three Runs (SV-325)*** | ND | ND | ND | ND | 12 | 0 |
| ***U3R-4 at Road A**** | 0.10 | 0.60 | -2.66 | 3.27 | 12 | NR |
| Beaver Dam Creek (SV-2040) | ND | ND | ND | ND | 12 | 0 |
| ***Four Mile Creek (SV-2039)*** | ND | ND | ND | ND | 12 | 0 |
| ***FM-6 Road A-12.2**** | 1.53 | 0.67 | -1.85 | 6.51 | 12 | NR |
| ***Pen Branch (SV-2047)*** | ND | ND | ND | ND | 12 | 0 |
| ***PB-3 at Road A-13.2**** | 0.02 | 0.62 | -3.11 | 2.43 | 12 | NR |
| ***Steel Creek (SV-327)*** | ND | ND | ND | ND | 12 | 0 |
| ***SC-4 Steel Creek at Road A**** | -0.45 | 0.61 | -2.73 | 3.03 | 12 | NR |
| *Steel Creek Boat Landing (SV-2018)* | ND | ND | ND | ND | 12 | 0 |
| ***Steel Creek Boat Ramp River Mile 141.5*** | -0.16 | 0.26 | -5.81 | 0.89 | 52 | NR |
| ***Lower Three Runs (SV-2053)*** | ND | ND | ND | ND | 12 | 0 |
| ***L3R-1A at Road B**** | 0.81 | 0.65 | -1.77 | 3.54 | 12 | NR |
| ***Highway 301 Bridge (SV-118)*** | ND | ND | ND | ND | 12 | 0 |
| ***River Mile 118.8**** | -0.11 | 0.06 | -1.69 | 1.73 | 52 | NR |
| Four Mile Creek (SV-2045) | 7.65 | 3.02 | 5.08 | 11.41 | 12 | 4 |
| McQueen Branch (SV-2069) | ND | ND | ND | ND | 12 | 0 |
| Upper Three Runs (SV-2071) | ND | ND | ND | ND | 12 | 0 |
| Upper Three Runs (SV-2073) | ND | ND | ND | ND | 12 | 0 |

Notes:
(1) *WSRC data from the SRS Environmental Data Report for 2006
(2) Bold and italicized entries represent colocated sampling stations for both organizations
(3) NR = Not reported.
(4) ND = None Detected.
(5) SD=Standard Deviation

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## Tables and Figures
## Radiological Monitoring of Surface Water

Table 3. Surface Water Gross Alpha Detection Data

| Sample Location | Ave. Conc. (pCi/L) | SD | Min. Conc. (pCi/L) | Max. Conc. (pCi/L) | # of Samples | # of Detects |
|---|---|---|---|---|---|---|
| Jackson Landing (SV-2010) | ND | ND | ND | ND | 12 | 0 |
| ***Upper Three Runs (SV-325)*** | 6.06 | 3.00 | 2.46 | 10.70 | 12 | 11 |
| ***U3R-4 at Road A**** | 8.50 | 0.23 | 0.98 | 20.00 | 12 | NR |
| Beaver Dam Creek (SV-2040) | 2.54 | 0.94 | 1.03 | 3.61 | 12 | 5 |
| ***Four Mile Creek (SV-2039)*** | 2.30 | 0.47 | 1.96 | 2.63 | 12 | 2 |
| ***FM-6 Road A-12.2**** | 2.13 | 0.10 | 0.02 | 14.00 | 12 | NR |
| ***Pen Branch (SV-2047)*** | 2.53 | 3.05 | 0.74 | 7.09 | 12 | 4 |
| ***PB-3 at Road 13.2**** | 1.98 | 0.16 | 0.11 | 4.92 | 12 | NR |
| ***Steel Creek (SV-327)*** | 2.45 | 1.00 | 1.34 | 3.28 | 12 | 3 |
| ***SC-4 Steel Creek at Road A**** | 1.14 | 0.08 | 0.24 | 4.27 | 12 | NR |
| *Steel Creek Boat Landing (SV-2018)* | 1.25 | N/A | 1.25 | 1.25 | 12 | 1 |
| ***Steel Creek Boat Ramp River Mile 141.5*** | 0.23 | 0.05 | -0.87 | 1.01 | 52 | NR |
| ***Lower Three Runs (SV-2053)*** | 2.43 | 1.41 | 0.96 | 3.77 | 12 | 3 |
| ***L3R-1A at Road B**** | 2.38 | 0.17 | 0.36 | 9.86 | 12 | NR |
| ***Highway 301 Bridge (SV-118)*** | 3.97 | 3.49 | 1.40 | 9.08 | 12 | 4 |
| ***River Mile 118.8**** | 0.26 | 0.05 | -0.64 | 1.05 | 52 | NR |
| Four Mile Creek (SV-2045) | 2.71 | 1.35 | 1.20 | 5.03 | 12 | 11 |
| McQueen Branch (SV-2069) | 1.28 | 0.45 | 0.97 | 1.60 | 12 | 2 |
| Upper Three Runs (SV-2071) | 4.42 | 2.49 | 2.45 | 11.30 | 12 | 11 |
| Upper Three Runs (SV-2073) | 4.89 | 2.74 | 2.12 | 10.80 | 12 | 10 |

Notes:
(1) *WSRC data from the SRS Environmental Data Report for 2006.
(2) Bold and italicized entries represent colocated sampling stations for both organizations.
(3) Conc. = Concentration (4) ND = None Detected (5) NR = Not Reported (6) N/A= Not Applicable

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## Tables and Figures
## Radiological Monitoring of Surface Water

Table 4. Surface Water Gross Beta Detection Data

| Sample Location | Avg Conc. (pCi/L) | SD | Min. Conc. (pCi/L) | Max. Conc. (pCi/L) | # of Samples | # of Detects |
|---|---|---|---|---|---|---|
| Jackson Landing (SV-2010) | 2.47 | 0.27 | 2.28 | 2.66 | 12 | 2 |
| ***Upper Three Runs (SV-325)*** | 4.05 | 0.82 | 3.11 | 4.59 | 12 | 3 |
| ***U3R-4 at Road A**** | 3.99 | 0.16 | 0.65 | 8.59 | 12 | NR |
| Beaver Dam Creek (SV-2040) | 4.43 | 0.86 | 3.53 | 5.24 | 12 | 3 |
| ***Four Mile Creek (SV-2039)*** | 5.55 | 1.57 | 3.53 | 8.32 | 12 | 11 |
| ***FM-6 Road A-12.2**** | 9.46 | 0.18 | 4.24 | 24.90 | 12 | NR |
| ***Pen Branch (SV-2047)*** | 3.87 | 0.98 | 2.78 | 4.66 | 12 | 3 |
| ***PB-3 at Road 13.2**** | 2.33 | 0.18 | 0.82 | 4.81 | 12 | NR |
| ***Steel Creek (SV-327)*** | 4.14 | N/A | 4.14 | 4.14 | 12 | 1 |
| ***SC-4 Steel Creek at Road A**** | 1.41 | 0.10 | 0.76 | 3.43 | 12 | NR |
| ***Steel Creek Boat Landing (SV-2018)*** | 3.41 | 0.64 | 2.96 | 3.86 | 12 | 2 |
| ***Steel Creek Boat Ramp River Mile 141.5*** | 2.24 | 0.10 | 0.16 | 14.90 | 52 | NR |
| ***Lower Three Runs (SV-2053)*** | 3.23 | 0.92 | 2.66 | 4.30 | 12 | 2 |
| ***L3R-1A at Road B**** | 4.18 | 0.22 | 0.65 | 11.60 | 12 | NR |
| ***Highway 301 Bridge (SV-118)*** | 6.67 | 2.87 | 4.64 | 8.70 | 12 | 2 |
| ***River Mile 118.8**** | 2.38 | 0.10 | 0.52 | 18.10 | 52 | NR |
| Four Mile Creek (SV-2045) | 14.13 | 3.89 | 9.61 | 21.60 | 12 | 12 |
| McQueen Branch (SV-2069) | 2.86 | N/A | 2.86 | 2.86 | 12 | 1 |
| Upper Three Runs (SV-2071) | 13.56 | 23.51 | 2.63 | 55.60 | 12 | 5 |
| Upper Three Runs (SV-2073) | 3.90 | 1.07 | 2.76 | 4.88 | 12 | 3 |

Notes:
(1) *WSRC data from the SRS Environmental Data Report for 2006.
(2) Bold and italicized entries represent colocated sampling stations for both organizations.
(3) Conc. = Concentration (4) ND = None Detected (5) NR = Not Reported (6) N/A= Not Applicable

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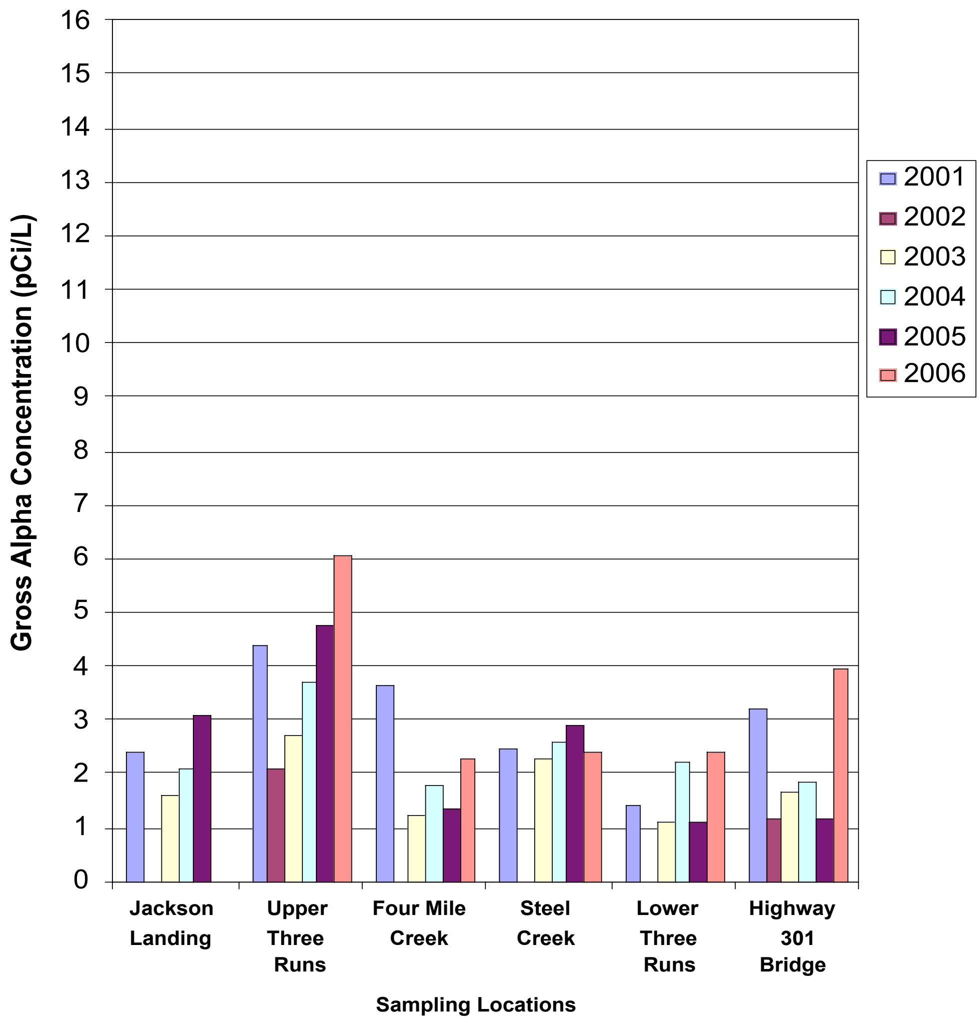
## Tables and Figures
## Radiological Monitoring of Surface Water

**Figure 1.**
**ESOP Average Gross Alpha Data**
**2001-2006**




Note:
1. EPA MCL is 15 pCi/L.

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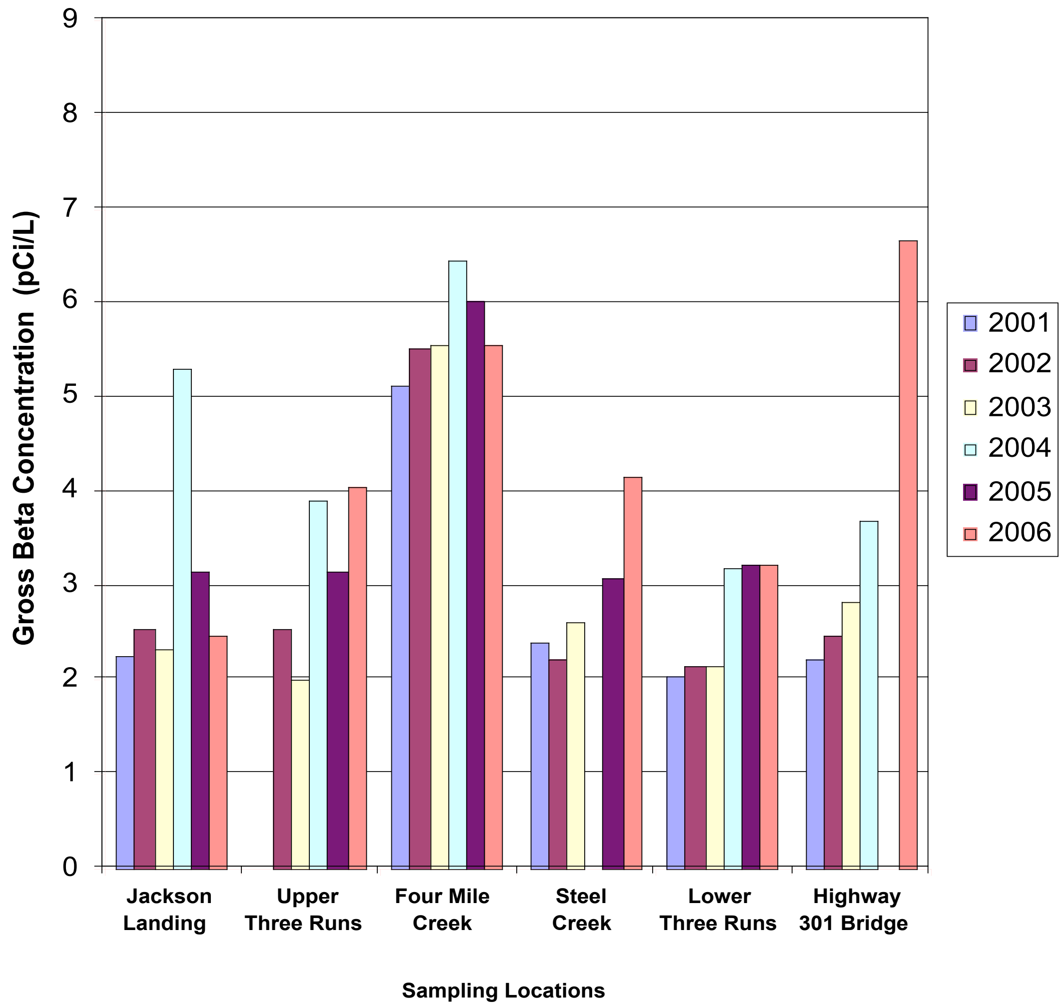
## Tables and Figures
## Radiological Monitoring of Surface Water

Figure 2.
ESOP Average Gross Beta Data
2001-2006




Note:
1. EPA MCL is 8 pCi/L.

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## 2.3.4 Data
## Radiological Monitoring of Surface Water



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# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Jackson Boat Landing (SV-2010) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | <LLD | | 0.900 | <LLD | | 2.65 | <MDA | | 2.04 |
| 01/04/06 | <186 | | | | | | | | | | |
| 01/11/06 | <183 | | | | | | | | | | |
| 01/18/06 | <190 | | | | | | | | | | |
| 01/25/06 | <181 | | | | | | | | | | |
| 02/01/06 | 187 | 81 | <LLD | | 1.20 | <LLD | | 2.78 | <MDA | | 3.80 |
| 02/08/06 | <185 | | | | | | | | | | |
| 02/15/06 | <195 | | | | | | | | | | |
| 02/22/06 | <192 | | | | | | | | | | |
| 03/01/06 | <195 | | <LLD | | 2.69 | <LLD | | 3.05 | <MDA | | 3.85 |
| 03/08/06 | <194 | | | | | | | | | | |
| 03/15/06 | <190 | | | | | | | | | | |
| 03/22/06 | <190 | | | | | | | | | | |
| 03/29/06 | <196 | | <LLD | | 1.56 | <LLD | | 2.53 | <MDA | | 1.88 |
| 04/05/06 | <179 | | | | | | | | | | |
| 04/12/06 | <192 | | | | | | | | | | |
| 04/19/06 | <201 | | | | | | | | | | |
| 04/26/06 | <193 | | <LLD | | 2.43 | <LLD | | 2.88 | <MDA | | 3.75 |
| 05/03/06* | <193 | | | | | | | | | | |
| 05/10/06 | <187 | | | | | | | | | | |
| 05/17/06 | <183 | | | | | | | | | | |
| 05/24/06 | 187 | 84 | | | | | | | | | |
| 05/31/06 | <191 | | <LLD | | 0.676 | 2.28 | 1.26 | 2.14 | <MDA | | 1.88 |
| 06/07/06 | 206 | 87 | | | | | | | | | |
| 06/14/06 | 212 | 87 | | | | | | | | | |
| 06/21/06 | <187 | | | | | | | | | | |
| 06/28/06 | <175 | | <LLD | | 1.95 | 2.66 | 1.45 | 2.54 | <MDA | | 3.69 |
| 07/05/06 | <193 | | | | | | | | | | |
| 07/12/06 | <186 | | | | | | | | | | |
| 07/19/06 | <198 | | | | | | | | | | |
| 07/26/06 | <189 | | <LLD | | 1.77 | <LLD | | 2.74 | <MDA | | 3.98 |
| 08/02/06 | <191 | | | | | | | | | | |
| 08/09/06 | <176 | | | | | | | | | | |
| 08/16/06 | <185 | | | | | | | | | | |
| 08/23/06 | <182 | | | | | | | | | | |
| 08/30/06 | <198 | | <LLD | | 1.82 | <LLD | | 2.88 | <MDA | | 3.42 |
| 09/06/06 | <200 | | | | | | | | | | |
| 09/13/06 | <184 | | | | | | | | | | |
| 09/20/06 | <204 | | | | | | | | | | |
| 09/27/06 | <200 | | <LLD | | 2.51 | <LLD | | 3.86 | <MDA | | 3.99 |
| 10/04/06 | <201 | | | | | | | | | | |
| 10/11/06 | <195 | | | | | | | | | | |
| 10/18/06 | <193 | | | | | | | | | | |
| 10/25/06 | <198 | | | | | | | | | | |
| 11/01/06 | <201 | | <LLD | | 1.79 | <LLD | | 4.07 | <MDA | | 3.75 |
| 11/08/06 | <196 | | | | | | | | | | |
| 11/15/06 | <189 | | | | | | | | | | |
| 11/22/06 | <193 | | | | | | | | | | |
| 11/29/06 | 213 | 92 | <LLD | | 2.29 | <LLD | | 3.90 | <MDA | | 3.30 |
| 12/06/06 | 226 | 89 | | | | | | | | | |
| 12/13/06 | <194 | | | | | | | | | | |
| 12/20/06 | <186 | | | | | | | | | | |
| 12/27/06 | <196 | | | | | | | | | | |
| N = | 6 | | | | | 2 | | | | | |
| Max. = | 226 | | | | | 2.66 | | | | | |
| Min. = | 187 | | | | | 2.28 | | | | | |
| Median = | 209 | | | | | 2.47 | | | | | |
| Ave. = | 205 | | | | | 2 | | | | | |
| Std. Dev.= | 15.51 | | | | | 0.27 | | | | | |

*Data cannot be validated or verified.

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## Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Date | Sample Location: Fourmile Branch @ Road C-7 (SV-2045) Tritium pCi/L | +/-2 Sigma | Date | Sample Location: SRS TNX Boat Landing (SV-2012) Tritium pCi/L | +/-2 Sigma |
|---|---|---|---|---|---|
| 01/04/06 | 148140 | 1074 | 01/04/06 | 331 | 93 |
| 01/11/06 | 305742 | 1526 | 01/11/06 | 204 | 86 |
| 01/18/06 | 169865 | 1142 | 01/18/06 | 252 | 91 |
| 01/25/06 | 283488 | 1475 | 01/25/06 | <181 | |
| 02/01/06 | 233069 | 1335 | 02/01/06 | 436 | 92 |
| 02/08/06 | 295777 | 1506 | 02/08/06 | <185 | |
| 02/15/06 | 302718 | 1526 | 02/15/06 | <195 | |
| 02/22/06 | 235356 | 1343 | 02/22/06 | <192 | |
| 03/01/06 | 230478 | 1332 | 03/01/06 | <195 | |
| 03/08/06 | 255616 | 1403 | 03/08/06 | 246 | 92 |
| 03/15/06 | 257317 | 1412 | 03/15/06 | 233 | 90 |
| 03/22/06 | 134619 | 1023 | 03/22/06 | <190 | |
| 03/29/06 | 256430 | 1405 | 03/29/06 | <196 | |
| 04/05/06 | 256487 | 1401 | 04/05/06 | 241 | 86 |
| 04/12/06 | 127105 | 1001 | 04/12/06 | <192 | |
| 04/19/06 | 126988 | 998 | 04/19/06 | <201 | |
| 04/26/06 | 141458 | 1050 | 04/26/06 | 234 | 91 |
| 05/03/06* | 143584 | 1055 | 05/03/06* | <193 | |
| 05/10/06 | 147135 | 1068 | 05/10/06 | 229 | 89 |
| 05/17/06 | 146012 | 1051 | 05/17/06 | <183 | |
| 05/24/06 | 141625 | 1045 | 05/24/06 | 226 | 86 |
| 05/31/06 | 93723 | 855 | 05/31/06 | <191 | |
| 06/07/06 | 163866 | 1123 | 06/07/06 | <183 | |
| 06/14/06 | 19818 | 407 | 06/14/06 | 299 | 91 |
| 06/21/06 | 20490 | 408 | 06/21/06 | <187 | |
| 06/28/06 | 131988 | 1010 | 06/28/06 | <175 | |
| 07/05/06 | 146049 | 1064 | 07/05/06 | <193 | |
| 07/12/06 | 141247 | 1040 | 07/12/06 | <186 | |
| 07/19/06 | 154161 | 1093 | 07/19/06 | <198 | |
| 07/26/06 | 155115 | 1095 | 07/26/06 | <189 | |
| 08/02/06 | 152229 | 1085 | 08/02/06 | <191 | |
| 08/09/06 | 151105 | 1077 | 08/09/06 | <176 | |
| 08/16/06 | 149357 | 1075 | 08/16/06 | <185 | |
| 08/23/06 | 152661 | 1082 | 08/23/06 | <182 | |
| 08/30/06 | 171070 | 1165 | 08/30/06 | 243 | 94 |
| 09/06/06 | 203338 | 1241 | 09/06/06 | <200 | |
| 09/13/06 | 198783 | 1252 | 09/13/06 | <184 | |
| 09/20/06 | 204649 | 1279 | 09/20/06 | <204 | |
| 09/27/06 | 173199 | 1167 | 09/27/06 | 236 | 95 |
| 10/04/06 | 168223 | 1163 | 10/04/06 | <201 | |
| 10/11/06 | 198626 | 1254 | 10/11/06 | 265 | 94 |
| 10/18/06 | 198187 | 1249 | 10/18/06 | 217 | 91 |
| 10/25/06 | 197764 | 1249 | 10/25/06 | 222 | 93 |
| 11/01/06 | 197211 | 1248 | 11/01/06 | <201 | |
| 11/08/06 | 249807 | 1407 | 11/08/06 | 311 | 96 |
| 11/15/06 | 204092 | 1267 | 11/15/06 | 219 | 90 |
| 11/22/06 | 203964 | 1264 | 11/22/06 | 214 | 91 |
| 11/29/06 | 246060 | 1395 | 11/29/06 | <197 | |
| 12/06/06 | 158525 | 1118 | 12/06/06 | <187 | |
| 12/13/06 | 157322 | 1111 | 12/13/06 | 197 | 91 |
| 12/20/06 | 157074 | 1106 | 12/20/06 | 237 | 89 |
| 12/27/06 | 157345 | 1112 | 12/27/06 | <196 | |
| N = | 52 | | N = | 21 | |
| Max. = | 305742 | | Max. = | 436 | |
| Min. = | 19818 | | Min. = | 197 | |
| Median = | 166044.5 | | Median = | 236 | |
| Ave. = | 181078 | | Ave. = | 252 | |
| Std. Dev.= | 60367.41 | | Std. Dev.= | 54.1073 | |

Note: Temporary dishcarge of phytoremediation pond (F Area) into Four Mile Creek commenced 08/19/05 @ 1545 hrs. Project completion date: Apr. 06
*Data cannot be validated or verified

**Back to List of Data Tables** **Back to 2.3.4 RSW Data**

## Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Upper Three Runs @ SC 125 (SV-325) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 2.46 | 0.990 | 0.81 | <LLD | | 2.64 | <MDA | | 1.76 |
| 01/04/06 | 1049 | 120 | | | | | | | | | |
| 01/11/06 | 762 | 109 | | | | | | | | | |
| 01/18/06 | 929 | 116 | | | | | | | | | |
| 01/25/06 | 1385 | 128 | | | | | | | | | |
| 02/01/06 | 1587 | 132 | 5.32 | 1.42 | 1.10 | <LLD | | 2.77 | <MDA | | 3.99 |
| 02/08/06 | 4414 | 200 | | | | | | | | | |
| 02/15/06 | 1632 | 139 | | | | | | | | | |
| 02/22/06 | 1448 | 133 | | | | | | | | | |
| 03/01/06 | 2017 | 150 | 2.83 | 1.53 | 2.40 | <LLD | | 3.03 | <MDA | | 4.00 |
| 03/08/06 | 2083 | 150 | | | | | | | | | |
| 03/15/06 | 1926 | 145 | | | | | | | | | |
| 03/22/06 | 1874 | 145 | | | | | | | | | |
| 03/29/06 | 1915 | 146 | 7.76 | 1.74 | 1.38 | 4.45 | 1.60 | 2.52 | <MDA | | 2.20 |
| 04/05/06 | 745 | 107 | | | | | | | | | |
| 04/12/06 | 1416 | 132 | | | | | | | | | |
| 04/19/06 | 1481 | 136 | | | | | | | | | |
| 04/26/06 | 1208 | 126 | 5.00 | 1.70 | 2.20 | <LLD | | 2.87 | <MDA | | 3.92 |
| 05/03/06* | 1112 | 131 | | | | | | | | | |
| 05/10/06 | 1143 | 122 | | | | | | | | | |
| 05/17/06 | 1037 | 117 | | | | | | | | | |
| 05/24/06 | 1121 | 119 | | | | | | | | | |
| 05/31/06 | 515 | 102 | 10.70 | 2.07 | 0.672 | 4.59 | 1.51 | 2.14 | <MDA | | 1.83 |
| 06/07/06 | 1022 | 117 | | | | | | | | | |
| 06/14/06 | 1888 | 143 | | | | | | | | | |
| 06/21/06 | 1858 | 142 | | | | | | | | | |
| 06/28/06 | 976 | 113 | 10.5 | 2.23 | 2.10 | 3.11 | 1.56 | 2.55 | <MDA | | 3.25 |
| 07/05/06 | 820 | 114 | | | | | | | | | |
| 07/12/06 | 865 | 112 | | | | | | | | | |
| 07/19/06 | 830 | 115 | | | | | | | | | |
| 07/26/06 | 1077 | 120 | 4.85 | 1.50 | 1.65 | <LLD | | 2.73 | <MDA | | 3.84 |
| 08/02/06 | 1110 | 122 | | | | | | | | | |
| 08/09/06 | 581 | 99 | | | | | | | | | |
| 08/16/06 | 466 | 98 | | | | | | | | | |
| 08/23/06 | 1118 | 120 | | | | | | | | | |
| 08/30/06 | 684 | 111 | 6.17 | 1.70 | 1.76 | <LLD | | 2.87 | <MDA | | 3.45 |
| 09/06/06 | 1312 | 136 | | | | | | | | | |
| 09/13/06 | 2404 | 157 | | | | | | | | | |
| 09/20/06 | 2447 | 163 | | | | | | | | | |
| 09/27/06 | 1359 | 133 | 8.60 | 2.10 | 2.26 | <LLD | | 3.85 | <MDA | | 3.30 |
| 10/04/06 | 1920 | 145 | | | | | | | | | |
| 10/11/06 | 1673 | 141 | | | | | | | | | |
| 10/18/06 | 1457 | 134 | | | | | | | | | |
| 10/25/06 | 1116 | 125 | | | | | | | | | |
| 11/01/06 | 1304 | 132 | 2.50 | 1.24 | 1.65 | <LLD | | 4.05 | <MDA | | 3.63 |
| 11/08/06 | 593 | 107 | | | | | | | | | |
| 11/15/06 | 931 | 117 | | | | | | | | | |
| 11/22/06 | 817 | 114 | | | | | | | | | |
| 11/29/06 | 668 | 110 | <LLD | | 2.02 | <LLD | | 3.88 | <MDA | | 3.30 |
| 12/06/06 | 885 | 115 | | | | | | | | | |
| 12/13/06 | 644 | 109 | | | | | | | | | |
| 12/20/06 | 785 | 111 | | | | | | | | | |
| 12/27/06 | 726 | 112 | | | | | | | | | |
| N = | 52 | | 11 | | | 3 | | | | | |
| Max. = | 4414 | | 10.70 | | | 4.59 | | | | | |
| Min. = | 466 | | 2.46 | | | 3.11 | | | | | |
| Median = | 1117 | | 5.32 | | | 4.45 | | | | | |
| Ave. = | 1291 | | 6.06 | | | 4.05 | | | | | |
| Std. Dev.= | 664.93 | | 3.00 | | | 0.82 | | | | | |

*Data cannot be validated or verified.

**Back to List of Data Tables** **Back to 2.3.4 RSW Data**

# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Beaver Dam Creek (SV-2040) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 1.03 | 0.81 | 0.97 | <LLD | | 2.66 | <MDA | | 1.90 |
| 01/04/06 | 537 | 101 | | | | | | | | | |
| 01/11/06 | 200 | 86 | | | | | | | | | |
| 01/18/06 | 230 | 90 | | | | | | | | | |
| 01/25/06 | 328 | 91 | | | | | | | | | |
| 02/01/06 | 237 | 83 | 1.82 | 1.06 | 1.31 | <LLD | | 2.79 | <MDA | | 3.64 |
| 02/08/06 | 203 | 87 | | | | | | | | | |
| 02/15/06 | <195 | | | | | | | | | | |
| 02/22/06 | 264 | 92 | | | | | | | | | |
| 03/01/06 | 291 | 95 | <LLD | | 2.70 | <LLD | | 3.05 | <MDA | | 3.98 |
| 03/08/06 | <194 | | | | | | | | | | |
| 03/15/06 | 337 | 95 | | | | | | | | | |
| 03/22/06 | <190 | | | | | | | | | | |
| 03/29/06 | 283 | 95 | <LLD | | 1.61 | <LLD | | 2.54 | <MDA | | 2.05 |
| 04/05/06 | 291 | 89 | | | | | | | | | |
| 04/12/06 | 287 | 93 | | | | | | | | | |
| 04/19/06 | 377 | 100 | | | | | | | | | |
| 04/26/06 | 244 | 92 | <LLD | | 2.79 | <LLD | | 2.90 | <MDA | | 3.97 |
| 05/03/06* | <193 | | | | | | | | | | |
| 05/10/06 | 420 | 97 | | | | | | | | | |
| 05/17/06 | 220 | 87 | | | | | | | | | |
| 05/24/06 | 345 | 91 | | | | | | | | | |
| 05/31/06 | 318 | 94 | 2.46 | 1.12 | 0.77 | 3.53 | 1.38 | 2.16 | <MDA | | 1.83 |
| 06/07/06 | 218 | 87 | | | | | | | | | |
| 06/14/06 | 270 | 89 | | | | | | | | | |
| 06/21/06 | <187 | | | | | | | | | | |
| 06/28/06 | 279 | 87 | <LLD | | 2.18 | <LLD | | 2.55 | <MDA | | 3.53 |
| 07/05/06 | <193 | | | | | | | | | | |
| 07/12/06 | <186 | | | | | | | | | | |
| 07/19/06 | <198 | | | | | | | | | | |
| 07/26/06 | <189 | | 3.61 | 1.52 | 1.94 | 4.52 | 1.67 | 2.76 | <MDA | | 3.81 |
| 08/02/06 | <191 | | | | | | | | | | |
| 08/09/06 | <176 | | | | | | | | | | |
| 08/16/06 | <185 | | | | | | | | | | |
| 08/23/06 | 282 | 89 | | | | | | | | | |
| 08/30/06 | 267 | 95 | 2.26 | 1.30 | 1.86 | 5.24 | 1.75 | 2.88 | <MDA | | 3.35 |
| 09/06/06 | 364 | 96 | | | | | | | | | |
| 09/13/06 | <184 | | | | | | | | | | |
| 09/20/06 | 295 | 98 | | | | | | | | | |
| 09/27/06 | 259 | 95 | <LLD | | 2.61 | <LLD | | 3.87 | <MDA | | 3.96 |
| 10/04/06 | 235 | 92 | | | | | | | | | |
| 10/11/06 | 258 | 94 | | | | | | | | | |
| 10/18/06 | 383 | 98 | | | | | | | | | |
| 10/25/06 | 243 | 94 | | | | | | | | | |
| 11/01/06 | 296 | 97 | <LLD | | 1.88 | <LLD | | 4.08 | <MDA | | 3.82 |
| 11/08/06 | <196 | | | | | | | | | | |
| 11/15/06 | 247 | 91 | | | | | | | | | |
| 11/22/06 | <193 | | | | | | | | | | |
| 11/29/06 | 201 | 92 | <LLD | | 2.33 | <LLD | | 3.91 | <MDA | | 3.36 |
| 12/06/06 | 319 | 93 | | | | | | | | | |
| 12/13/06 | <194 | | | | | | | | | | |
| 12/20/06 | <186 | | | | | | | | | | |
| 12/27/06 | 184 | 91 | | | | | | | | | |
| N = | 35 | | 5 | | | 3 | | | | | |
| Max. = | 537 | | 3.61 | | | 5.24 | | | | | |
| Min. = | 184 | | 1.03 | | | 3.53 | | | | | |
| Median = | 279 | | 2.26 | | | 4.52 | | | | | |
| Ave. = | 286 | | 2.54 | | | 4.43 | | | | | |
| Std. Dev.= | 71.08 | | 0.94 | | | 0.86 | | | | | |

*Data cannot be validated or verified.

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# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Four Mile Creek @ Road A-13 (SV-2039) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 1.96 | 0.94 | 0.86 | 3.92 | 1.59 | 2.65 | <MDA | | 2.31 |
| 01/04/06 | 73008 | 755 | | | | | | | | | |
| 01/11/06 | 106123 | 904 | | | | | | | | | |
| 01/18/06 | 123518 | 971 | | | | | | | | | |
| 01/25/06 | 112377 | 929 | | | | | | | | | |
| 02/01/06 | 119790 | 959 | <LLD | | 1.13 | 4.68 | 1.67 | 2.77 | <MDA | | 3.99 |
| 02/08/06 | 112936 | 927 | | | | | | | | | |
| 02/15/06 | 121368 | 967 | | | | | | | | | |
| 02/22/06 | 123147 | 971 | | | | | | | | | |
| 03/01/06 | 93113 | 848 | <LLD | | 2.46 | 4.17 | 1.76 | 3.04 | <MDA | | 3.99 |
| 03/08/06 | 110406 | 923 | | | | | | | | | |
| 03/15/06 | 115632 | 943 | | | | | | | | | |
| 03/22/06 | 106376 | 908 | | | | | | | | | |
| 03/29/06 | 115772 | 943 | <LLD | | 1.46 | 4.96 | 1.59 | 2.53 | <MDA | | 2.49 |
| 04/05/06 | 95186 | 857 | | | | | | | | | |
| 04/12/06 | 61147 | 694 | | | | | | | | | |
| 04/19/06 | 62504 | 701 | | | | | | | | | |
| 04/26/06 | 62539 | 698 | <LLD | | 2.36 | <LLD | | 2.88 | <MDA | | 3.85 |
| 05/03/06* | 62915 | 701 | | | | | | | | | |
| 05/10/06 | 64017 | 704 | | | | | | | | | |
| 05/17/06 | 63786 | 694 | | | | | | | | | |
| 05/24/06 | 60601 | 684 | | | | | | | | | |
| 05/31/06 | 57095 | 665 | <LLD | | 0.642 | 5.68 | 1.49 | 2.13 | <MDA | | 2.38 |
| 06/07/06 | 53549 | 645 | | | | | | | | | |
| 06/14/06 | 47977 | 611 | | | | | | | | | |
| 06/21/06 | 48622 | 608 | | | | | | | | | |
| 06/28/06 | 60015 | 679 | <LLD | | 1.90 | 3.53 | 1.50 | 2.53 | <MDA | | 3.72 |
| 07/05/06 | 61471 | 690 | | | | | | | | | |
| 07/12/06 | 58098 | 663 | | | | | | | | | |
| 07/19/06 | 59484 | 679 | | | | | | | | | |
| 07/26/06 | 59041 | 675 | <LLD | | 1.72 | 4.97 | 1.68 | 2.74 | <MDA | | 3.87 |
| 08/02/06 | 49271 | 617 | | | | | | | | | |
| 08/09/06 | 54900 | 650 | | | | | | | | | |
| 08/16/06 | 54154 | 647 | | | | | | | | | |
| 08/23/06 | 50121 | 621 | | | | | | | | | |
| 08/30/06 | 55651 | 662 | 2.63 | 1.29 | 1.75 | 6.20 | 1.80 | 2.87 | <MDA | | 3.28 |
| 09/06/06 | 61188 | 677 | | | | | | | | | |
| 09/13/06 | 52008 | 637 | | | | | | | | | |
| 09/20/06 | 58280 | 683 | | | | | | | | | |
| 09/27/06 | 63740 | 708 | <LLD | | 2.37 | 7.63 | 2.28 | 3.85 | <MDA | | 3.98 |
| 10/04/06 | 61787 | 698 | | | | | | | | | |
| 10/11/06 | 63426 | 709 | | | | | | | | | |
| 10/18/06 | 62427 | 703 | | | | | | | | | |
| 10/25/06 | 63509 | 710 | | | | | | | | | |
| 11/01/06 | 62276 | 702 | <LLD | | 1.75 | 8.32 | 2.39 | 4.07 | <MDA | | 3.98 |
| 11/08/06 | 64327 | 714 | | | | | | | | | |
| 11/15/06 | 72292 | 757 | | | | | | | | | |
| 11/22/06 | 72219 | 756 | | | | | | | | | |
| 11/29/06 | 62385 | 702 | <LLD | | 2.14 | 7.03 | 2.27 | 3.89 | <MDA | | 3.51 |
| 12/06/06 | 64415 | 716 | | | | | | | | | |
| 12/13/06 | 63629 | 710 | | | | | | | | | |
| 12/20/06 | 63984 | 709 | | | | | | | | | |
| 12/27/06 | 63290 | 709 | | | | | | | | | |
| N = | 52 | | 2 | | | 11 | | | | | |
| Max. = | 123518 | | 2.63 | | | 8.32 | | | | | |
| Min. = | 47977 | | 1.96 | | | 3.53 | | | | | |
| Median = | 63102.5 | | 2.30 | | | 4.97 | | | | | |
| Ave. = | 73286 | | 2.30 | | | 5.55 | | | | | |
| Std. Dev.= | 23613.71 | | 0.47 | | | 1.57 | | | | | |

*Temporary discharge of phytoremediation pond (F Area) into Four Mile Creek commenced 08/19/05 @ 1545hrs. Project completion date: Apr. '06.
*Data cannot be validated or verified.

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## Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Pen Branch @ Road A-13 (SV-2047) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 0.99 | 0.77 | 0.93 | <LLD | | 2.66 | <MDA | | 2.12 |
| 01/04/06 | 20114 | 403 | | | | | | | | | |
| 01/11/06 | 27635 | 468 | | | | | | | | | |
| 01/18/06 | 33078 | 508 | | | | | | | | | |
| 01/25/06 | 30573 | 490 | | | | | | | | | |
| 02/01/06 | 34928 | 523 | 1.31 | 0.92 | 1.22 | <LLD | | 2.78 | <MDA | | 3.74 |
| 02/08/06 | 33180 | 511 | | | | | | | | | |
| 02/15/06 | 36187 | 535 | | | | | | | | | |
| 02/22/06 | 37561 | 543 | | | | | | | | | |
| 03/01/06 | 27417 | 467 | <LLD | | 2.73 | <LLD | | 3.05 | <MDA | | 4.00 |
| 03/08/06 | 33792 | 518 | | | | | | | | | |
| 03/15/06 | 36729 | 539 | | | | | | | | | |
| 03/22/06 | 35855 | 532 | | | | | | | | | |
| 03/29/06 | 37201 | 542 | <LLD | | 1.56 | 4.17 | 1.54 | 2.53 | <MDA | | 1.97 |
| 04/05/06 | 39135 | 554 | | | | | | | | | |
| 04/12/06 | 37053 | 546 | | | | | | | | | |
| 04/19/06 | 37127 | 546 | | | | | | | | | |
| 04/26/06 | 43892 | 586 | <LLD | | 2.42 | <LLD | | 2.88 | <MDA | | 3.76 |
| 05/03/06* | 45815 | 590 | | | | | | | | | |
| 05/10/06 | 49805 | 622 | | | | | | | | | |
| 05/17/06 | 49893 | 615 | | | | | | | | | |
| 05/24/06 | 44553 | 588 | | | | | | | | | |
| 05/31/06 | 53284 | 645 | 0.740 | 0.646 | 0.690 | 4.66 | 1.43 | 2.14 | <MDA | | 1.92 |
| 06/07/06 | 49501 | 621 | | | | | | | | | |
| 06/14/06 | 51608 | 632 | | | | | | | | | |
| 06/21/06 | 51478 | 634 | | | | | | | | | |
| 06/28/06 | 48167 | 610 | <LLD | | 2.03 | 2.78 | 1.47 | 2.54 | <MDA | | 2.92 |
| 07/05/06 | 51934 | 633 | | | | | | | | | |
| 07/12/06 | 54260 | 640 | | | | | | | | | |
| 07/19/06 | 52878 | 640 | | | | | | | | | |
| 07/26/06 | 52732 | 638 | <LLD | | 1.82 | <LLD | | 2.75 | <MDA | | 3.96 |
| 08/02/06 | 46303 | 599 | | | | | | | | | |
| 08/09/06 | 53824 | 642 | | | | | | | | | |
| 08/16/06 | 54552 | 647 | | | | | | | | | |
| 08/23/06 | 47012 | 602 | | | | | | | | | |
| 08/30/06 | 53578 | 648 | <LLD | | 1.83 | <LLD | | 2.88 | <MDA | | 3.42 |
| 09/06/06 | 66846 | 740 | | | | | | | | | |
| 09/13/06 | 58701 | 675 | | | | | | | | | |
| 09/20/06 | 65725 | 724 | | | | | | | | | |
| 09/27/06 | 66017 | 721 | <LLD | | 2.50 | <LLD | | 3.86 | <MDA | | 3.98 |
| 10/04/06 | 65017 | 720 | | | | | | | | | |
| 10/11/06 | 66685 | 728 | | | | | | | | | |
| 10/18/06 | 69738 | 742 | | | | | | | | | |
| 10/25/06 | 68371 | 735 | | | | | | | | | |
| 11/01/06 | 69200 | 739 | <LLD | | 1.82 | <LLD | | 4.07 | <MDA | | 3.71 |
| 11/08/06 | 65259 | 719 | | | | | | | | | |
| 11/15/06 | 56010 | 666 | | | | | | | | | |
| 11/22/06 | 55697 | 663 | | | | | | | | | |
| 11/29/06 | 64350 | 713 | 7.09 | 2.01 | 2.29 | <LLD | | 3.9 | <MDA | | 3.38 |
| 12/06/06 | 51918 | 644 | | | | | | | | | |
| 12/13/06 | 50840 | 636 | | | | | | | | | |
| 12/20/06 | 50896 | 633 | | | | | | | | | |
| 12/27/06 | 50959 | 639 | | | | | | | | | |
| N = | 52 | | 4 | | | 3 | | | | | |
| Max. = | 69738 | | 7.09 | | | 4.66 | | | | | |
| Min. = | 20114 | | 0.74 | | | 2.78 | | | | | |
| Median = | 50868 | | 1.15 | | | 4.17 | | | | | |
| Ave. = | 48747 | | 2.53 | | | 3.87 | | | | | |
| Std. Dev.= | 12354.01 | | 3.05 | | | 0.98 | | | | | |

*Data cannot be validated or verified.

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## Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Steel Creek @ SC 125 (SV-327) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 1.34 | 0.83 | 0.89 | <LLD | | 2.65 | <MDA | | 2.18 |
| 01/04/06 | 2035 | 148 | | | | | | | | | |
| 01/11/06 | 2288 | 153 | | | | | | | | | |
| 01/18/06 | 2577 | 161 | | | | | | | | | |
| 01/25/06 | 2436 | 157 | | | | | | | | | |
| 02/01/06 | 2415 | 154 | <LLD | | 1.21 | <LLD | | 2.78 | <MDA | | 4.00 |
| 02/08/06 | 1939 | 145 | | | | | | | | | |
| 02/15/06 | 2386 | 158 | | | | | | | | | |
| 02/22/06 | 2219 | 153 | | | | | | | | | |
| 03/01/06 | 1936 | 147 | <LLD | | 2.29 | <LLD | | 2.87 | <MDA | | 3.98 |
| 03/08/06 | 1800 | 143 | | | | | | | | | |
| 03/15/06 | 2190 | 152 | | | | | | | | | |
| 03/22/06 | 2089 | 150 | | | | | | | | | |
| 03/29/06 | 2538 | 162 | <LLD | | 1.61 | <LLD | | 2.54 | <MDA | | 2.03 |
| 04/05/06 | 2545 | 159 | | | | | | | | | |
| 04/12/06 | 2618 | 164 | | | | | | | | | |
| 04/19/06 | 2515 | 164 | | | | | | | | | |
| 04/26/06 | 2527 | 161 | <LLD | | 2.62 | <LLD | | 2.89 | <MDA | | 3.95 |
| 05/03/06* | 2763 | 174 | | | | | | | | | |
| 05/10/06 | 2984 | 170 | | | | | | | | | |
| 05/17/06 | 2812 | 164 | | | | | | | | | |
| 05/24/06 | 3039 | 170 | | | | | | | | | |
| 05/31/06 | 3830 | 190 | 2.74 | 1.20 | 0.797 | 4.14 | 1.42 | 2.16 | <MDA | | 2.17 |
| 06/07/06 | 3539 | 182 | | | | | | | | | |
| 06/14/06 | 3435 | 180 | | | | | | | | | |
| 06/21/06 | 3229 | 174 | | | | | | | | | |
| 06/28/06 | 2969 | 167 | <LLD | | 1.99 | <LLD | | 2.54 | <MDA | | 3.60 |
| 07/05/06 | 3367 | 180 | | | | | | | | | |
| 07/12/06 | 4338 | 195 | | | | | | | | | |
| 07/19/06 | 3917 | 191 | | | | | | | | | |
| 07/26/06 | 2181 | 152 | <LLD | | 1.78 | <LLD | | 2.75 | <MDA | | 4.00 |
| 08/02/06 | 1871 | 144 | | | | | | | | | |
| 08/09/06 | 2520 | 157 | | | | | | | | | |
| 08/16/06 | 2461 | 158 | | | | | | | | | |
| 08/23/06 | 2002 | 146 | | | | | | | | | |
| 08/30/06 | 2873 | 170 | 3.28 | 1.5 | 1.99 | <LLD | | 2.89 | <MDA | | 3.23 |
| 09/06/06 | 3196 | 176 | | | | | | | | | |
| 09/13/06 | 2505 | 169 | | | | | | | | | |
| 09/20/06 | 3242 | 181 | | | | | | | | | |
| 09/27/06 | 3833 | 192 | <LLD | | 2.81 | <LLD | | 3.88 | <MDA | | 3.92 |
| 10/04/06 | 3663 | 189 | | | | | | | | | |
| 10/11/06 | 3935 | 194 | | | | | | | | | |
| 10/18/06 | 3477 | 184 | | | | | | | | | |
| 10/25/06 | 3718 | 190 | | | | | | | | | |
| 11/01/06 | 3586 | 187 | <LLD | | 1.84 | <LLD | | 4.08 | <MDA | | 3.98 |
| 11/08/06 | 3177 | 178 | | | | | | | | | |
| 11/15/06 | 2937 | 172 | | | | | | | | | |
| 11/22/06 | 3133 | 177 | | | | | | | | | |
| 11/29/06 | 3163 | 178 | <LLD | | 2.21 | <LLD | | 3.89 | <MDA | | 3.36 |
| 12/06/06 | 2579 | 163 | | | | | | | | | |
| 12/13/06 | 2702 | 167 | | | | | | | | | |
| 12/20/06 | 2550 | 161 | | | | | | | | | |
| 12/27/06 | 2691 | 167 | | | | | | | | | |
| N = | 52 | | 3 | | | 1 | | | | | |
| Max. = | 4338 | | 3.28 | | | 4.14 | | | | | |
| Min. = | 1800 | | 1.34 | | | 4.14 | | | | | |
| Ave. = | 2832 | | 2.45 | | | 4.14 | | | | | |
| Median = | 2697 | | 2.74 | | | 4.14 | | | | | |
| Std. Dev.= | 620.68 | | 1.00 | | | NA | | | | | |

*Data cannot be validated or verified.

**Back to List of Data Tables** **Back to 2.3.4 RSW Data**

# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Steel Creek Landing @ RM 141 (SV-2018) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 1.25 | 0.83 | 0.92 | <LLD | | 2.65 | <MDA | | 2.03 |
| 01/04/06 | 2918 | 169 | | | | | | | | | |
| 01/11/06 | 646 | 104 | | | | | | | | | |
| 01/18/06 | 1202 | 126 | | | | | | | | | |
| 01/25/06 | 794 | 109 | | | | | | | | | |
| 02/01/06 | 1063 | 115 | <LLD | | 1.22 | <LLD | | 2.78 | <MDA | | 4.00 |
| 02/08/06 | 769 | 109 | | | | | | | | | |
| 02/15/06 | 315 | 96 | | | | | | | | | |
| 02/22/06 | 668 | 108 | | | | | | | | | |
| 03/01/06 | 1436 | 134 | <LLD | | 2.60 | <LLD | | 3.04 | <MDA | | 3.74 |
| 03/08/06 | 1115 | 123 | | | | | | | | | |
| 03/15/06 | 884 | 115 | | | | | | | | | |
| 03/22/06 | <190 | | | | | | | | | | |
| 03/29/06 | 861 | 116 | <LLD | | 1.61 | 2.96 | 1.47 | 2.54 | <MDA | | 1.75 |
| 04/05/06 | 558 | 100 | | | | | | | | | |
| 04/12/06 | 349 | 96 | | | | | | | | | |
| 04/19/06 | 365 | 100 | | | | | | | | | |
| 04/26/06 | 9931 | 288 | <LLD | | 2.45 | <LLD | | 2.88 | <MDA | | 3.89 |
| 05/03/06* | 9976 | 293 | | | | | | | | | |
| 05/10/06 | 581 | 103 | | | | | | | | | |
| 05/17/06 | 306 | 90 | | | | | | | | | |
| 05/24/06 | 911 | 112 | | | | | | | | | |
| 05/31/06 | <191 | | <LLD | | 0.68 | 3.86 | 1.37 | 2.14 | <MDA | | 2.01 |
| 06/07/06 | 273 | 90 | | | | | | | | | |
| 06/14/06 | 420 | 95 | | | | | | | | | |
| 06/21/06 | 1161 | 122 | | | | | | | | | |
| 06/28/06 | 410 | 92 | <LLD | | 1.98 | <LLD | | 2.54 | <MDA | | 3.41 |
| 07/05/06 | 216 | 91 | | | | | | | | | |
| 07/12/06 | 227 | 88 | | | | | | | | | |
| 07/19/06 | <198 | | | | | | | | | | |
| 07/26/06 | <189 | | <LLD | | 1.77 | <LLD | | 2.74 | <MDA | | 3.61 |
| 08/02/06 | <191 | | | | | | | | | | |
| 08/09/06 | 221 | 85 | | | | | | | | | |
| 08/16/06 | <185 | | | | | | | | | | |
| 08/23/06 | <182 | | | | | | | | | | |
| 08/30/06 | 200 | 92 | <LLD | | 1.84 | <LLD | | 2.88 | <MDA | | 3.48 |
| 09/06/06 | 447 | 99 | | | | | | | | | |
| 09/13/06 | 370 | 94 | | | | | | | | | |
| 09/20/06 | 402 | 103 | | | | | | | | | |
| 09/27/06 | 332 | 98 | <LLD | | 2.51 | <LLD | | 3.87 | <MDA | | 3.64 |
| 10/04/06 | 389 | 97 | | | | | | | | | |
| 10/11/06 | 285 | 95 | | | | | | | | | |
| 10/18/06 | 338 | 96 | | | | | | | | | |
| 10/25/06 | 398 | 100 | | | | | | | | | |
| 11/01/06 | 339 | 99 | <LLD | | 1.85 | <LLD | | 4.08 | <MDA | | 4.00 |
| 11/08/06 | 390 | 99 | | | | | | | | | |
| 11/15/06 | 312 | 94 | | | | | | | | | |
| 11/22/06 | 388 | 98 | | | | | | | | | |
| 11/29/06 | 341 | 98 | <LLD | | 2.28 | <LLD | | 3.9 | <MDA | | 3.24 |
| 12/06/06 | 472 | 99 | | | | | | | | | |
| 12/13/06 | 403 | 99 | | | | | | | | | |
| 12/20/06 | 290 | 92 | | | | | | | | | |
| 12/27/06 | 329 | 97 | | | | | | | | | |
| N = | 45 | | 1 | | | 2 | | | | | |
| Max. = | 9976 | | 1.25 | | | 3.86 | | | | | |
| Min. = | 200 | | 1.25 | | | 2.96 | | | | | |
| Median = | 402 | | 1.25 | | | 3.41 | | | | | |
| Ave. = | 1000 | | 1.25 | | | 3.41 | | | | | |
| Std. Dev.= | 2007.65 | | NA | | | 0.64 | | | | | |

*Data cannot be validated or verified.

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# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Little Hell Boat Landing (SV-2019) | | | Sample Location: Upper Three Runs @ Road 2-1 (SV-2027) | | |
|---|---|---|---|---|---|
| Date | Tritium pCi/L | +/-2 Sigma | Date | Tritium pCi/L | +/-2 Sigma |
| 01/04/06 | 389 | 95 | 01/04/06 | 346 | 94 |
| 01/11/06 | 543 | 101 | 01/11/06 | 197 | 86 |
| 01/18/06 | <190 | | 01/18/06 | 285 | 93 |
| 01/25/06 | 342 | 92 | 01/25/06 | 309 | 90 |
| 02/01/06 | 479 | 94 | 02/01/06 | 350 | 88 |
| 02/08/06 | 250 | 89 | 02/08/06 | <185 | |
| 02/15/06 | 523 | 104 | 02/15/06 | <195 | |
| 02/22/06 | 433 | 99 | 02/22/06 | <192 | |
| 03/01/06 | 205 | 91 | 03/01/06 | 199 | 91 |
| 03/08/06 | 663 | 108 | 03/08/06 | 231 | 92 |
| 03/15/06 | 295 | 93 | 03/15/06 | <190 | |
| 03/22/06 | <190 | | 03/22/06 | 269 | 93 |
| 03/29/06 | 267 | 94 | 03/29/06 | 239 | 93 |
| 04/05/06 | 528 | 98 | 04/05/06 | 285 | 88 |
| 04/12/06 | 302 | 94 | 04/12/06 | 248 | 91 |
| 04/19/06 | <201 | | 04/19/06 | 230 | 95 |
| 04/26/06 | 248 | 92 | 04/26/06 | 226 | 91 |
| 05/03/06* | 255 | 92 | 05/03/06* | <193 | |
| 05/10/06 | 691 | 108 | 05/10/06 | 241 | 90 |
| 05/17/06 | 745 | 108 | 05/17/06 | <183 | |
| 05/24/06 | 612 | 102 | 05/24/06 | 309 | 90 |
| 05/31/06 | 795 | 112 | 05/31/06 | <191 | |
| 06/07/06 | 383 | 94 | 06/07/06 | 220 | 87 |
| 06/14/06 | 376 | 94 | 06/14/06 | <183 | |
| 06/21/06 | 264 | 90 | 06/21/06 | 236 | 89 |
| 06/28/06 | 246 | 85 | 06/28/06 | 229 | 85 |
| 07/05/06 | 279 | 93 | 07/05/06 | <193 | |
| 07/12/06 | 956 | 116 | 07/12/06 | 317 | 92 |
| 07/19/06 | <198 | | 07/19/06 | <198 | |
| 07/26/06 | <189 | | 07/26/06 | <189 | |
| 08/02/06 | <191 | | 08/02/06 | 225 | 90 |
| 08/09/06 | 523 | 97 | 08/09/06 | 278 | 87 |
| 08/16/06 | 563 | 102 | 08/16/06 | 233 | 89 |
| 08/23/06 | 202 | 86 | 08/23/06 | 212 | 86 |
| 08/30/06 | <198 | | 08/30/06 | <198 | |
| 09/06/06 | 1155 | 121 | 09/06/06 | 496 | 103 |
| 09/13/06 | 1406 | 130 | 09/13/06 | 308 | 92 |
| 09/20/06 | 1539 | 140 | 09/20/06 | 232 | 96 |
| 09/27/06 | 794 | 115 | 09/27/06 | 243 | 95 |
| 10/04/06 | 1944 | 146 | 10/04/06 | 314 | 97 |
| 10/11/06 | 531 | 105 | 10/11/06 | 213 | 92 |
| 10/18/06 | 414 | 99 | 10/18/06 | <193 | |
| 10/25/06 | 270 | 95 | 10/25/06 | <198 | |
| 11/01/06 | 368 | 100 | 11/01/06 | 331 | 99 |
| 11/08/06 | 229 | 92 | 11/08/06 | 298 | 96 |
| 11/15/06 | 299 | 93 | 11/15/06 | 246 | 91 |
| 11/22/06 | 339 | 96 | 11/22/06 | 191 | 90 |
| 11/29/06 | 180 | 91 | 11/29/06 | <197 | |
| 12/06/06 | 510 | 101 | 12/06/06 | <187 | |
| 12/13/06 | 552 | 105 | 12/13/06 | 262 | 93 |
| 12/20/06 | 373 | 95 | 12/20/06 | 209 | 88 |
| 12/27/06 | 308 | 96 | 12/27/06 | 259 | 94 |
| N= | 45 | | N = | 36 | |
| Max. = | 1944 | | Max.= | 496 | |
| Min. = | 180 | | Min.= | 191 | |
| Median = | 389 | | Median = | 244.5 | |
| Ave. = | 524 | | Ave.= | 264 | |
| Std. Dev.= | 370.14 | | Std. Dev.= | 58.97 | |

*Data cannot be validated or verified.

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## Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: US-301 Bridge (SV-118) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | 1.4 | 0.86 | 0.92 | <LLD | | 2.66 | <MDA | | 2.09 |
| 01/04/06 | 757 | 109 | | | | | | | | | |
| 01/11/06 | 566 | 101 | | | | | | | | | |
| 01/18/06 | 566 | 103 | | | | | | | | | |
| 01/25/06 | 453 | 96 | | | | | | | | | |
| 02/01/06 | 901 | 109 | <LLD | | 1.23 | <LLD | | 2.78 | <MDA | | 3.88 |
| 02/08/06 | 490 | 99 | | | | | | | | | |
| 02/15/06 | 637 | 108 | | | | | | | | | |
| 02/22/06 | 647 | 107 | | | | | | | | | |
| 03/01/06 | 865 | 116 | <LLD | | 2.62 | <LLD | | 3.04 | <MDA | | 4.00 |
| 03/08/06 | 646 | 108 | | | | | | | | | |
| 03/15/06 | 634 | 106 | | | | | | | | | |
| 03/22/06 | 251 | 91 | | | | | | | | | |
| 03/29/06 | 703 | 110 | <LLD | | 1.92 | <LLD | | 3.01 | <MDA | | 1.93 |
| 04/05/06 | 825 | 109 | | | | | | | | | |
| 04/12/06 | 313 | 95 | | | | | | | | | |
| 04/19/06 | 513 | 106 | | | | | | | | | |
| 04/26/06 | 709 | 109 | 9.08 | 2.20 | 2.45 | <LLD | | 2.88 | <MDA | | 3.97 |
| 05/03/06* | 2173 | 152 | | | | | | | | | |
| 05/10/06 | 769 | 110 | | | | | | | | | |
| 05/17/06 | 969 | 115 | | | | | | | | | |
| 05/24/06 | 755 | 106 | | | | | | | | | |
| 05/31/06 | 1001 | 118 | 2.14 | 1.01 | 0.71 | 4.64 | 1.44 | 2.15 | <MDA | | 1.78 |
| 06/07/06 | 422 | 96 | | | | | | | | | |
| 06/14/06 | 270 | 89 | | | | | | | | | |
| 06/21/06 | 262 | 90 | | | | | | | | | |
| 06/28/06 | 555 | 98 | <LLD | | 2.12 | <LLD | | 2.55 | <MDA | | 3.38 |
| 07/05/06 | 216 | 91 | | | | | | | | | |
| 07/12/06 | 489 | 99 | | | | | | | | | |
| 07/19/06 | 218 | 92 | | | | | | | | | |
| 07/26/06 | 266 | 91 | <LLD | | 1.83 | <LLD | | 2.75 | <MDA | | 3.65 |
| 08/02/06 | 398 | 97 | | | | | | | | | |
| 08/09/06 | 501 | 96 | | | | | | | | | |
| 08/16/06 | 422 | 96 | | | | | | | | | |
| 08/23/06 | 321 | 91 | | | | | | | | | |
| 08/30/06 | 266 | 95 | 3.24 | 1.45 | 1.89 | 8.70 | 1.93 | 2.88 | <MDA | | 3.32 |
| 09/06/06 | 1049 | 127 | | | | | | | | | |
| 09/13/06 | 1444 | 131 | | | | | | | | | |
| 09/20/06 | 1288 | 132 | | | | | | | | | |
| 09/27/06 | 505 | 105 | <LLD | | 2.55 | <LLD | | 3.87 | <MDA | | 4.00 |
| 10/04/06 | 2498 | 161 | | | | | | | | | |
| 10/11/06 | 446 | 101 | | | | | | | | | |
| 10/18/06 | 451 | 100 | | | | | | | | | |
| 10/25/06 | 275 | 95 | | | | | | | | | |
| 11/01/06 | 304 | 98 | <LLD | | 1.90 | <LLD | | 4.08 | <MDA | | 4.00 |
| 11/08/06 | 283 | 95 | | | | | | | | | |
| 11/15/06 | 255 | 91 | | | | | | | | | |
| 11/22/06 | 187 | 90 | | | | | | | | | |
| 11/29/06 | 319 | 97 | <LLD | | 2.33 | <LLD | | 3.91 | <MDA | | 3.41 |
| 12/06/06 | 291 | 92 | | | | | | | | | |
| 12/13/06 | 436 | 101 | | | | | | | | | |
| 12/20/06 | 373 | 95 | | | | | | | | | |
| 12/27/06 | 325 | 97 | | | | | | | | | |
| N = | 52 | | 4 | | | 2 | | | | | |
| Max. = | 2498 | | 9.08 | | | 8.70 | | | | | |
| Min. = | 187 | | 1.40 | | | 4.64 | | | | | |
| Median = | 489.5 | | 2.69 | | | 6.67 | | | | | |
| Ave. = | 605 | | 3.97 | | | 6.67 | | | | | |
| Std. Dev.= | 448.04 | | 3.49 | | | 2.87 | | | | | |

*Data cannot be validated or verified.

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# Radiological Monitoring of Surface Water
## Radiological Surface Water Data

| Sample Location: Lower Three Runs @ Road B (SV-2053) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Tritium | | Gross Alpha | | | Gross Beta | | | Cs-137 | | |
| | pCi/L | +/-2 Sigma | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | MDA |
| 12/28/05 | NR | NR | <LLD | | 0.84 | 2.66 | 1.5 | 2.64 | <MDA | | 2.25 |
| 01/04/06 | 452 | 97 | | | | | | | | | |
| 01/11/06 | 296 | 90 | | | | | | | | | |
| 01/18/06 | 370 | 96 | | | | | | | | | |
| 01/25/06 | 404 | 93 | | | | | | | | | |
| 02/01/06 | 400 | 90 | <LLD | | 1.12 | <LLD | | 2.77 | <MDA | | 3.98 |
| 02/08/06 | 380 | 94 | | | | | | | | | |
| 02/15/06 | 411 | 99 | | | | | | | | | |
| 02/22/06 | 424 | 98 | | | | | | | | | |
| 03/01/06 | 359 | 97 | <LLD | | 2.41 | <LLD | | 3.03 | <MDA | | 4.00 |
| 03/08/06 | 471 | 101 | | | | | | | | | |
| 03/15/06 | 371 | 96 | | | | | | | | | |
| 03/22/06 | 401 | 97 | | | | | | | | | |
| 03/29/06 | 388 | 98 | <LLD | | 1.44 | <LLD | | 2.53 | <MDA | | 2.44 |
| 04/05/06 | 596 | 101 | | | | | | | | | |
| 04/12/06 | 551 | 103 | | | | | | | | | |
| 04/19/06 | 336 | 98 | | | | | | | | | |
| 04/26/06 | 372 | 97 | <LLD | | 2.30 | <LLD | | 2.88 | <MDA | | 3.72 |
| 05/03/06* | 462 | 105 | | | | | | | | | |
| 05/10/06 | 421 | 96 | | | | | | | | | |
| 05/17/06 | 487 | 97 | | | | | | | | | |
| 05/24/06 | 432 | 94 | | | | | | | | | |
| 05/31/06 | 329 | 94 | 0.957 | 0.677 | 0.64 | 2.74 | 1.3 | 2.13 | <MDA | | 2.12 |
| 06/07/06 | 443 | 96 | | | | | | | | | |
| 06/14/06 | 413 | 95 | | | | | | | | | |
| 06/21/06 | 444 | 97 | | | | | | | | | |
| 06/28/06 | 418 | 92 | <LLD | | 1.90 | <LLD | | 2.53 | <MDA | | 3.78 |
| 07/05/06 | 471 | 101 | | | | | | | | | |
| 07/12/06 | 378 | 94 | | | | | | | | | |
| 07/19/06 | 417 | 100 | | | | | | | | | |
| 07/26/06 | 343 | 93 | <LLD | | 1.71 | <LLD | | 2.74 | <MDA | | 4.00 |
| 08/02/06 | 393 | 97 | | | | | | | | | |
| 08/09/06 | 427 | 93 | | | | | | | | | |
| 08/16/06 | 347 | 93 | | | | | | | | | |
| 08/23/06 | 340 | 92 | | | | | | | | | |
| 08/30/06 | 295 | 96 | <LLD | | 1.73 | <LLD | | 2.87 | <MDA | | 3.63 |
| 09/06/06 | 377 | 93 | | | | | | | | | |
| 09/13/06 | 421 | 96 | | | | | | | | | |
| 09/20/06 | 364 | 101 | | | | | | | | | |
| 09/27/06 | 386 | 101 | 2.57 | 1.63 | 2.54 | <LLD | | 3.87 | <MDA | | 4.00 |
| 10/04/06 | 288 | 97 | | | | | | | | | |
| 10/11/06 | 522 | 105 | | | | | | | | | |
| 10/18/06 | 578 | 107 | | | | | | | | | |
| 10/25/06 | 451 | 103 | | | | | | | | | |
| 11/01/06 | 486 | 105 | <LLD | | 1.73 | <LLD | | 4.06 | <MDA | | 3.98 |
| 11/08/06 | 457 | 101 | | | | | | | | | |
| 11/15/06 | 385 | 96 | | | | | | | | | |
| 11/22/06 | 566 | 105 | | | | | | | | | |
| 11/29/06 | 345 | 97 | 3.77 | 1.56 | 2.10 | 4.30 | 2.17 | 3.88 | <MDA | | 3.42 |
| 12/06/06 | 458 | 98 | | | | | | | | | |
| 12/13/06 | 383 | 98 | | | | | | | | | |
| 12/20/06 | 308 | 92 | | | | | | | | | |
| 12/27/06 | 325 | 96 | | | | | | | | | |
| N = | 52 | | 3 | | | 2 | | | | | |
| Max. = | 596 | | 3.77 | | | 4.30 | | | | | |
| Min. = | 288 | | 0.96 | | | 2.66 | | | | | |
| Median = | 403 | | 2.57 | | | 2.74 | | | | | |
| Ave. = | 410 | | 2.43 | | | 3.23 | | | | | |
| Std. Dev.= | 70.92 | | 1.41 | | | 0.92 | | | | | |

*Data cannot be validated or verified.

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# Radiological Monitoring of Surface Water
## Boat Run Data

Sample Location: Upper Three Runs @ RM 157.4 (SV-2011)

| Date | Tritium pCi/L | +/-2 Sigma |
|---|---|---|
| 01/09/06 | 485 | 103 |
| 04/10/06 | 580 | 109 |
| 07/17/06 | 465 | 98 |
| 11/20/06 | 510 | 104 |
| Detects: | 4 | |
| Average: | 510 | |
| SD: | 50 | |
| Median: | 498 | |
| Max: | 580 | |
| Min: | 465 | |

Sample Location: Beaver Dam Creek Mouth @ RM 152.3 (SV-2013)

| Date | Tritium pCi/L | +/-2 Sigma |
|---|---|---|
| 01/09/06 | <196 | |
| 04/10/06 | 237 | 95 |
| 07/17/06 | 192 | 86 |
| 11/20/06 | <195 | |
| Detects: | 2 | |
| Average: | 215 | |
| SD: | 32 | |
| Median: | 215 | |
| Max: | 237 | |
| Min: | 192 | |

Sample Location: Four Mile Creek @ RM 150.6 (SV-2015)

| Date | Tritium (at Creek Mouth (CM) pCi/L | +/-2 Sigma | Tritium (30 Feet from CM) pCi/L | +/-2 Sigma | Tritium (150 Feet from CM) pCi/L | +/-2 Sigma |
|---|---|---|---|---|---|---|
| 01/09/06 | 98505 | 872 | 21486 | 413 | 58206 | 672 |
| 04/10/06 | 60987 | 698 | 54758 | 660 | 27003 | 466 |
| 07/17/06 | 62963 | 697 | 25105 | 444 | 15294 | 350 |
| 11/20/06 | 59042 | 687 | 58902 | 685 | 17868 | 383 |
| Detects: | 4 | | 4 | | 4 | |
| Average: | 70374 | | 40063 | | 29593 | |
| SD: | 18822 | | 19491 | | 19726 | |
| Median: | 61975 | | 39932 | | 22436 | |
| Max: | 98505 | | 58902 | | 58206 | |
| Min: | 59042 | | 21486 | | 15294 | |

Sample Location: Steel Creek Mouth @ RM 141.8 (SV-2017)

| Date | Tritium pCi/L | +/-2 Sigma |
|---|---|---|
| 01/09/06 | 10335 | 294 |
| 04/10/06 | 5053 | 220 |
| 07/17/06 | 3683 | 184 |
| 11/20/06 | 1780 | 142 |
| Detects: | 4 | |
| Average: | 5213 | |
| SD: | 3669 | |
| Median: | 4368 | |
| Max: | 10335 | |
| Min: | 1780 | |

Sample Location: Lower Three Runs Mouth @ RM 129 (SV-2020)

| Date | Tritium pCi/L | +/-2 Sigma |
|---|---|---|
| 01/09/06 | 760 | 112 |
| 04/10/06 | 645 | 111 |
| 07/17/06 | 2117 | 148 |
| 11/20/06 | 1203 | 127 |
| Detects: | 4 | |
| Average: | 1181 | |
| SD: | 669 | |
| Median: | 982 | |
| Max: | 2117 | |
| Min: | 645 | |

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## Radiological Monitoring of Surface Water
## Random Sample Data

| Environmental/Background Samples 2006 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Location | Date | Tritium | | Date Analyzed | Gross Alpha | | | Gross Beta | | | Date Analyzed | Cs-137 | | | Date Analyzed |
| | | pCi/L | +/-2 Sigma | | pCi/L | +/-2 Sigma | LLD | pCi/L | +/-2 Sigma | LLD | | pCi/L | +/-2 Sigma | MDA | |
| **E-35** | 02/02/06 | 230 | 92 | 02/22/06 | <LLD | | 2.94 | <LLD | | 3.08 | 04/04/06 | <MDA | | 3.60 | 04/12/06 |
| **NR-41** | 02/02/06 | <195 | | 02/22/06 | <LLD | | 2.26 | <LLD | | 3.04 | 04/04/06 | <MDA | | 3.57 | 04/12/06 |
| **E-34** | 02/06/06 | <195 | | 02/22/06 | <LLD | | 2.21 | <LLD | | 3.04 | 04/05/06 | <MDA | | 3.35 | 04/12/06 |
| **B-41** | 02/06/06 | <195 | | 02/22/06 | <LLD | | 2.37 | <LLD | | 3.05 | 04/05/06 | <MDA | | 3.32 | 04/12/06 |
| **B-32** | 02/06/06 | <195 | | 02/22/06 | <LLD | | 2.76 | <LLD | | 3.07 | 04/05/06 | <MDA | | 3.46 | 04/12/06 |
| **B-26** | 02/10/06 | <195 | | 02/22/06 | <LLD | | 2.57 | <LLD | | 3.06 | 04/04/06 | <MDA | | 3.98 | 05/11/06 |
| **B-29** | 02/10/06 | <195 | | 02/22/06 | <LLD | | 2.57 | <LLD | | 3.06 | 04/04/06 | <MDA | | 3.98 | 05/11/06 |
| **B-31** | 02/10/06 | <195 | | 02/22/06 | <LLD | | 2.41 | <LLD | | 3.05 | 04/04/06 | <MDA | | 3.98 | 05/15/06 |
| **E-31** | 03/14/06 | <202 | | 03/14/06 | 2.24 | 1.33 | 2.01 | 4.20 | 2.05 | 3.65 | 06/30/06 | <MDA | | 3.93 | 05/25/06 |
| **E-33** | 03/14/06 | <202 | | 03/14/06 | <LLD | | 2.16 | <LLD | | 3.67 | 06/30/06 | <MDA | | 3.95 | 05/25/06 |
| **E-36** | 03/14/06 | <202 | | 03/14/06 | <LLD | | 2.07 | 7.05 | 2.17 | 3.66 | 06/30/06 | <MDA | | 3.66 | 05/25/06 |
| **B-33*** | 04/27/06 | <183 | | 06/16/06 | <LLD | | 2.09 | <LLD | | 2.57 | 09/04/06 | <MDA | | 2.16 | 05/30/06 |
| **B-36** | 04/27/06 | <183 | | 06/16/06 | <LLD | | 1.91 | <LLD | | 2.56 | 09/04/06 | <MDA | | 1.92 | 05/30/06 |
| **B-37** | 04/27/06 | <183 | | 06/16/06 | <LLD | | 2.06 | <LLD | | 2.57 | 09/04/06 | <MDA | | 1.89 | 05/30/06 |
| **B-8** | 04/12/06 | <183 | | 06/16/06 | <LLD | | 1.43 | <LLD | | 2.52 | 09/03/06 | <MDA | | 2.02 | 05/26/06 |
| **B-34** | 05/18/06 | <180 | | 06/05/06 | <LLD | | 2.97 | <LLD | | 2.91 | 08/28/06 | <MDA | | 4.00 | 06/16/06 |
| **E-13** | 05/25/06 | <183 | | 06/14/06 | <LLD | | 2.66 | <LLD | | 2.90 | 08/28/06 | <MDA | | 3.59 | 06/16/06 |
| **E-11** | 05/25/06 | <183 | | 06/14/06 | <LLD | | 2.19 | <LLD | | 2.87 | 08/28/06 | <MDA | | 3.84 | 06/15/06 |
| **B-28** | 09/14/06 | NS* | | | 2.28 | 1.23 | 1.65 | 3.00 | 1.64 | 2.90 | 11/14/07 | <MDA | | 3.49 | 11/14/06 |
| **B-30** | 09/14/06 | NS* | | | 1.87 | 1.23 | 1.77 | <LLD | | 2.91 | 11/14/07 | <MDA | | 3.58 | 11/14/06 |
| **E-32** | 07/31/06 | <191 | | 08/10/06 | <LLD | | 1.89 | <LLD | | 2.53 | 10/29/06 | <MDA | | 3.37 | 09/14/06 |
| **E-29** | 10/27/06 | <195 | | 12/16/06 | <LLD | | 2.62 | <LLD | | 3.87 | 12/10/06 | <MDA | | 3.48 | 12/06/06 |
| **E-37*** | 10/27/06 | <195 | | 12/16/06 | <LLD | | 3.44 | 5.22 | 2.22 | 3.92 | 12/09/06 | <MDA | | 3.64 | 12/06/06 |
| **E-39** | 10/27/06 | <195 | | 12/16/06 | <LLD | | 3.12 | <LLD | | 3.90 | 12/09/06 | <MDA | | 4.00 | 12/06/06 |
| **B-25** | 11/20/06 | <193 | | 05/12/06 | <LLD | | 2.47 | 4.50 | 2.18 | 3.92 | 01/27/07 | <MDA | | 3.93 | 12/19/06 |
| **E-5** | 11/20/06 | <193 | | 05/12/06 | <LLD | | 2.57 | 8.25 | 2.34 | 3.93 | 01/27/07 | <MDA | | 3.99 | 12/18/06 |
| **E-6** | 11/30/06 | <187 | | 12/17/06 | <LLD | | 2.00 | <LLD | | 3.87 | 01/27/07 | <MDA | | 3.61 | 12/19/06 |
| **E-9** | 11/30/06 | <187 | | 12/17/06 | <LLD | | 1.99 | 4.77 | 2.16 | 3.87 | 01/27/07 | <MDA | | 3.98 | 12/20/06 |
| | No. Detects = | 1 | | | 3 | | | 3 | | | | 0 | | | |
| | Max. = | 230 | | | 2.28 | | | 7.05 | | | | 0 | | | |
| | Min. = | 230 | | | 1.87 | | | 3 | | | | 0 | | | |
| | Median = | 230 | | | 2.24 | | | 4.20 | | | | N/A | | | |
| | Average = | 230 | | | 2.13 | | | 4.75 | | | | N/A | | | |
| | Std. Dev. = | N/A | | | N/A | | | N/A | | | | N/A | | | |

Note: HTO Dup #1 = B-29

* Dup.

"NS' indicates

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# Radiological Monitoring of Surface Water
# Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 01/13/06 | 01/13/06 | 01/13/06 | 01/30/06 | 01/30/06 | 01/30/06 | 01/30/06 |
| Tritium | (pCi/L) | 2.62E+05 | 6.83E+02 | 7.17E+02 | 2.62E+05 | 2.70E+03 | 7.41E+02 | 7.99E+02 |
| ±2 | (sigma) | 1.42E+03 | 1.09E+02 | 1.11E+02 | 1.42E+03 | 1.66E+02 | 1.12E+02 | 1.14E+02 |
| Gross Alpha | (pCi/L) | <LLD | 2.43E+00 | <LLD | 1.20E+00 | 9.68E-01 | 3.48E+00 | 2.12E+00 |
| ±2 | (sigma) | | 1.10E+00 | | 6.58E-01 | 6.04E-01 | 1.09E+00 | 8.48E-01 |
| LLD | (pCi/L) | 1.21E+00 | 1.19E+00 | 1.15E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Gross Non-volatile Beta | (pCi/L) | 1.10E+01 | 2.84E+00 | <LLD | 1.14E+01 | <LLD | <LLD | <LLD |
| ±2 | (sigma) | 1.87E+00 | 1.41E+00 | | 1.94E+00 | | | |
| LLD | (pCi/L) | 2.32E+00 | 2.32E+00 | 2.31E+00 | 2.46E+00 | 2.47E+00 | 2.45E+00 | 2.45E+00 |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | pCi/L) | 4.74E+01 | 4.90E+01 | 4.58E+01 | 3.94E+01 | 3.96E+01 | 3.79E+01 | 3.90E+01 |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 2.01E+00 | 2.10E+00 | 2.29E+00 | 1.83E+00 | 1.92E+00 | 2.20E+00 | 1.79E+00 |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 3.73E+01 | 3.60E+01 | 3.27E+00 | 3.35E+01 | 3.51E+01 | 3.24E+01 | 3.33E+01 |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 2.19E+00 | 2.41E+00 | 2.16E+00 | 2.39E+00 | 2.30E+00 | 2.15E+00 | 2.20E+00 |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 3.80E+00 | 4.06E+00 | 3.85E+00 | 3.73E+00 | 3.28E+00 | 3.71E+00 | 3.50E+00 |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 1.86E+00 | 2.13E+00 | 2.04E+00 | 1.80E+00 | 1.80E+00 | 1.89E+00 | 2.05E+00 |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 4.36E+00 | 4.62E+00 | 4.84E+00 | 4.22E+00 | 4.68E+00 | 4.30E+00 | 5.10E+00 |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 3.23E+00 | 3.53E+00 | 2.89E+00 | 2.44E+00 | 3.12E+00 | 2.88E+00 | 2.87E+00 |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 7.50E+00 | 7.28E+00 | 7.63E+00 | 6.62E+00 | 7.03E+00 | 6.57E+00 | 7.46E+00 |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 7.08E+00 | 8.57E+00 | 7.94E+00 | 6.67E+00 | 5.83E+00 | 6.71E+00 | 6.47E+00 |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 6.17E+00 | 5.90E+00 | 5.87E+00 | 6.09E+00 | 5.77E+00 | 5.41E+00 | 6.17E+00 |
| Iodine-131 | (pCi/L) | * | * | * | * | * | * | * |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | | | | | | | |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 2.09E+00 | 2.09E+00 | 2.09E+00 | 1.96E+00 | 2.01E+00 | 1.98E+00 | 1.96E+00 |
| Cesium-137 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 2.09E+00 | 1.93E+00 | 2.24E+00 | 2.18E+00 | 2.14E+00 | 1.72E+00 | 2.14E+00 |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 1.88E+01 | 2.01E+01 | 1.88E+01 | 1.90E+01 | 1.79E+01 | 1.91E+01 | 1.83E+01 |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 5.73E+00 | 6.15E+00 | 6.04E+00 | 6.86E+00 | 6.03E+00 | 5.91E+00 | 5.81E+00 |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 4.09E+00 | 4.51E+00 | 4.40E+00 | 4.83E+00 | 4.36E+00 | 4.29E+00 | 4.25E+00 |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 7.32E+00 | 8.01E+00 | 1.01E+01 | 8.20E+00 | 7.42E+00 | 7.30E+00 | 7.12E+00 |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 3.86E+00 | 4.24E+00 | 5.19E+00 | 4.32E+00 | 3.84E+00 | 3.93E+00 | 3.91E+00 |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 4.97E+00 | 5.87E+00 | 4.83E+00 | 6.22E+00 | 4.75E+00 | 4.81E+00 | 5.13E+00 |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | |
| MDA | (pCi/L) | 5.97E+01 | 6.07E+01 | 4.65E+01 | 5.93E+01 | 5.88E+01 | 5.66E+01 | 5.97E+01 |

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# Radiological Monitoring of Surface Water Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 03/06/06 | 03/06/06 | 03/06/06 | 03/06/06 | 04/07/06 | 04/07/06 | 04/07/06 | 04/07/06 |
| Tritium | (pCi/L) | 2.27E+05 | 2.55E+03 | 1.10E+03 | 5.94E+02 | 1.33E+05 | 2.67E+03 | 6.10E+02 | 7.25E+02 |
| ±2 | (sigma) | 1.33E+03 | 1.63E+02 | 1.25E+02 | 1.07E+02 | 1.01E+03 | 1.61E+02 | 1.02E+02 | 1.06E+02 |
| Gross Alpha | (pCi/L) | 2.52E+00 | <LLD | 3.56E+00 | 3.53E+00 | <LLD | x | 2.90E+00 | x |
| ±2 | (sigma) | 1.07E+00 | | 1.18E+00 | 1.17E+00 | | x | 1.48E+00 | x |
| LLD | (pCi/L) | 1.12E+00 | 1.15E+00 | 1.07E+00 | 1.06E+00 | 2.32E+00 | x | 2.13E+00 | x |
| Gross Non-volatile Beta | (pCi/L) | 1.20E+01 | <LLD | <LLD | <LLD | 1.81E+01 | x | <LLD | x |
| ±2 | (sigma) | 2.04E+00 | | | | 2.70E+00 | x | | x |
| LLD | (pCi/L) | 2.77E+00 | 2.77E+00 | 2.76E+00 | 2.76E+00 | 3.93E+00 | x | 3.91E+00 | x |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | pCi/L) | 4.30E+01 | 4.07E+01 | 3.79E+01 | 4.49E+01 | 4.80E+01 | x | 4.35E+01 | x |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 2.099E+00 | 1.70E+00 | 1.81E+00 | 2.16E+00 | 3.65E+00 | x | 3.35E+00 | x |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 3.775E+01 | 3.43E+01 | 3.55E+01 | 3.53E+01 | 4.325E+01 | x | 4.91E+01 | x |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 2.26E+00 | 2.25E+00 | 1.92E+00 | 2.22E+00 | 3.36E+00 | x | 3.45E+00 | x |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 3.18E+00 | 3.56E+00 | 3.92E+00 | 3.76E+00 | 4.24E+00 | x | 4.47E+00 | x |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 2.08E+00 | 1.90E+00 | 2.07E+00 | 1.76E+00 | 3.40E+00 | x | 3.05E+00 | x |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 4.96E+00 | 4.92E+00 | 4.58E+00 | 4.91E+00 | 6.21E+00 | x | 8.00E+00 | x |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 2.51E+00 | 3.01E+00 | 2.87E+00 | 2.59E+00 | 4.60E+00 | x | 3.99E+00 | x |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 6.10E+00 | 6.98E+00 | 6.03E+00 | 6.02E+00 | 9.14E+00 | x | 1.01E+01 | x |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 6.84E+00 | 6.86E+00 | 6.65E+00 | 6.40E+00 | 7.14E+00 | x | 6.60E+00 | x |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 5.49E+00 | 5.76E+00 | 6.04E+00 | 6.26E+00 | 8.92E+00 | x | 8.62E+00 | x |
| Iodine-131 | (pCi/L) | * | * | * | * | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | | | | | 1.60E+02 | x | 1.48E+02 | x |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 1.94E+00 | 1.95E+00 | 1.97E+00 | 2.07E+00 | 3.24E+00 | x | 3.22E+00 | x |
| Cesium-137 | (pCi/L) | 5.33E+00 | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | 2.06E+00 | | | | | x | | x |
| MDA | (pCi/L) | 1.97E+00 | 1.91E+00 | 2.12E+00 | 1.95E+00 | 3.45E+00 | x | 3.55E+00 | x |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 1.84E+01 | 1.89E+01 | 1.88E+01 | 1.92E+01 | 2.61E+01 | x | 2.50E+01 | x |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 6.34E+00 | 6.31E+00 | 5.89E+00 | 6.17E+00 | 9.04E+00 | x | 8.68E+00 | x |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 4.65E+00 | 4.52E+00 | 4.24E+00 | 4.52E+00 | 6.23E+00 | x | 6.29E+00 | x |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 7.53E+00 | 8.04E+00 | 7.17E+00 | 7.49E+00 | 9.60E+00 | x | 9.51E+00 | x |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 4.00E+00 | 3.90E+00 | 3.98E+00 | 4.10E+00 | 4.18E+00 | x | 4.32E+00 | x |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 4.84E+00 | 5.27E+00 | 5.06E+00 | 4.22E+00 | 7.52E+00 | x | 7.39E+00 | x |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | x | <MDA | x |
| ±2 | (sigma) | | | | | | x | | x |
| MDA | (pCi/L) | 6.00E+01 | 6.10E+01 | 5.99E+01 | 6.02E+01 | 8.46E+01 | x | 7.98E+01 | x |

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# Radiological Monitoring of Surface Water Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 05/01/06 | 05/01/06 | 05/01/06 | 05/01/06 | 06/01/06 | 06/01/06 | 06/01/06 | 06/01/06 |
| Tritium | (pCi/L) | 1.46E+05 | 3.10E+03 | 6.26E+02 | 6.43E+02 | NS | NS | NS | NS |
| ±2 | (sigma) | 1.06E+03 | 1.71E+02 | 1.03E+02 | 1.04E+02 | NS | NS | NS | NS |
| Gross Alpha | (pCi/L) | 3.05E+00 | <MDA | 4.01E+00 | 3.28E+00 | 1.59E+00 | 1.60E+00 | 5.23E+00 | 4.89E+00 |
| ±2 | (sigma) | 1.29E+00 | | 1.32E+00 | 1.22E+00 | 9.09E-01 | 1.13E+00 | 1.50E+00 | 1.36E+00 |
| LLD | (pCi/L) | 1.51E+00 | 1.53E+00 | 1.34E+00 | 1.34E+00 | 7.41E-01 | 1.06E+00 | 6.97E-01 | 6.15E-01 |
| Gross Non-volatile Beta | (pCi/L) | 1.44E+01 | <LLD | 2.73E+00 | <LLD | 1.51E+01 | 2.86E+00 | 4.02E+00 | <LLD |
| ±2 | (sigma) | 2.05E+00 | | 1.47E+00 | | 2.02E+00 | 1.35E+00 | 1.43E+00 | |
| LLD | (pCi/L) | 2.53E+00 | 2.53E+00 | 2.52E+00 | 2.52E+00 | 2.15E+00 | 2.23E+00 | 2.14E+00 | 2.12E+00 |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | pCi/L) | 2.86E+01 | 2.69E+01 | 2.61E+01 | 2.72E+01 | 5.38E+01 | 5.69E+01 | 5.94E+01 | 5.69E+01 |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.01E+00 | 1.74E+00 | 2.00E+00 | 1.88E+00 | 3.029E+00 | 2.76E+00 | 3.07E+00 | 2.77E+00 |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.76E+01 | 3.80E+01 | 3.59E+01 | 3.27E+01 | 7.197E+01 | 7.32E+01 | 7.19E+01 | 7.66E+01 |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.09E+00 | 1.88E+00 | 1.98E+00 | 1.98E+00 | 3.33E+00 | 3.07E+00 | 3.24E+00 | 3.45E+00 |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.51E+00 | 2.61E+00 | 2.91E+00 | 2.57E+00 | 4.60E+00 | 4.90E+00 | 5.01E+00 | 4.84E+00 |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.73E+00 | 1.59E+00 | 2.05E+00 | 1.78E+00 | 2.67E+00 | 2.61E+00 | 2.70E+00 | 3.09E+00 |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.64E+00 | 3.92E+00 | 4.13E+00 | 3.92E+00 | 7.59E+00 | 6.63E+00 | 7.11E+00 | 7.32E+00 |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.06E+00 | 2.73E+00 | 2.02E+00 | 2.15E+00 | 3.04E+00 | 3.10E+00 | 3.49E+00 | 3.68E+00 |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 5.34E+00 | 4.99E+00 | 4.77E+00 | 4.42E+00 | 9.53E+00 | 9.46E+00 | 9.57E+00 | 9.76E+00 |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.70E+00 | 3.37E+00 | 3.74E+00 | 4.28E+00 | 8.43E+00 | 8.07E+00 | 8.50E+00 | 8.61E+00 |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 5.74E+00 | 5.52E+00 | 5.77E+00 | 5.39E+00 | 1.03E+01 | 1.03E+01 | 1.02E+01 | 9.97E+00 |
| Iodine-131 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.72E+01 | 8.00E+01 | 9.15E+01 | 8.90E+01 | 3.72E+02 | 3.76E+02 | 4.24E+02 | 4.19E+02 |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.04E+00 | 1.90E+00 | 2.11E+00 | 2.01E+00 | 3.20E+00 | 3.20E+00 | 3.13E+00 | 3.23E+00 |
| Cesium-137 | (pCi/L) | 5.08E+00 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | 2.42E+00 | | | | | | | |
| MDA | (pCi/L) | 1.95E+00 | 1.95E+00 | 2.08E+00 | 2.05E+00 | 3.29E+00 | 3.26E+00 | 3.32E+00 | 3.36E+00 |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.14E+01 | 1.74E+01 | 1.60E+01 | 1.77E+01 | 3.88E+01 | 3.89E+01 | 3.94E+01 | 4.00E+01 |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.28E+00 | 6.11E+00 | 5.93E+00 | 5.93E+00 | 1.13E+01 | 1.12E+01 | 1.14E+01 | 1.14E+01 |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.64E+00 | 4.24E+00 | 4.09E+00 | 4.06E+00 | 8.25E+00 | 7.58E+00 | 8.35E+00 | 7.55E+00 |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.23E+00 | 7.52E+00 | 7.95E+00 | 7.19E+00 | 1.69E+01 | 1.70E+01 | 1.67E+01 | 1.72E+01 |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.24E+00 | 3.84E+00 | 4.06E+00 | 3.89E+00 | 8.25E+00 | 8.00E+00 | 8.35E+00 | 8.35E+00 |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.71E+00 | 4.45E+00 | 5.82E+00 | 5.16E+00 | 7.84E+00 | 8.73E+00 | 8.85E+00 | 8.81E+00 |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 5.96E+01 | 5.84E+01 | 6.25E+01 | 6.20E+01 | 1.08E+02 | 1.04E+02 | 1.08E+02 | 1.06E+02 |

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# Radiological Monitoring of Surface Water Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 07/07/06 | 07/07/06 | 07/07/06 | 07/07/06 | 08/07/06 | 08/07/06 | 08/07/06 | 08/07/06 |
| Tritium | (pCi/L) | 1.46E+05 | 2.85E+03 | 5.54E+02 | 6.14E+02 | 1.91E+05 | 3.04E+03 | 3.77E+02 | 5.68E+02 |
| ±2 | (sigma) | 1.07E+03 | 1.70E+02 | 1.05E+02 | 1.07E+02 | 1.22E+03 | 1.74E+02 | 9.90E+01 | 1.06E+02 |
| Gross Alpha | (pCi/L) | <LLD | <LLD | 4.23E+00 | 3.07E+00 | 5.03E+00 | <LLD | 4.44E+00 | 3.83E+00 |
| ±2 | (sigma) | | | 1.65E+00 | 1.52E+00 | 1.61E+00 | | 1.44E+00 | 1.37E+00 |
| LLD | (pCi/L) | 2.36E+00 | 2.67E+00 | 2.23E+00 | 2.23E+00 | 1.80E+00 | 1.77E+00 | 1.63E+00 | 1.62E+00 |
| Gross Non-volatile Beta | (pCi/L) | 1.17E+01 | <LLD | <LLD | <LLD | 1.44E+01 | <LLD | <LLD | <LLD |
| ±2 | (sigma) | 2.03E+00 | | | | 2.14E+00 | | | |
| LLD | (pCi/L) | 2.79E+00 | 2.81E+00 | 2.78E+00 | 2.78E+00 | 2.75E+00 | 2.74E+00 | 2.73E+00 | 2.73E+00 |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | pCi/L) | 6.69E+01 | 6.42E+01 | 6.45E+01 | 6.41E+01 | 5.61E+01 | 5.60E+01 | 6.01E+01 | 5.51E+01 |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.449E+00 | 3.00E+00 | 3.43E+00 | 2.93E+00 | 3.316E+00 | 3.85E+00 | 3.35E+00 | 3.22E+00 |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.288E+01 | 6.74E+01 | 6.33E+01 | 2.47E+01 | 6.859E+01 | 6.84E+01 | 7.63E+01 | 2.62E+01 |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.32E+00 | 3.67E+00 | 3.33E+00 | 3.32E+00 | 3.43E+00 | 3.20E+00 | 3.57E+00 | 3.18E+00 |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.22E+00 | 5.61E+00 | 6.12E+00 | 5.75E+00 | 4.95E+00 | 5.04E+00 | 5.27E+00 | 4.95E+00 |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.16E+00 | 2.84E+00 | 2.61E+00 | 2.94E+00 | 3.09E+00 | 2.98E+00 | 3.02E+00 | 3.13E+00 |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.11E+00 | 7.22E+00 | 7.67E+00 | 6.03E+00 | 6.84E+00 | 7.30E+00 | 6.93E+00 | 8.46E+00 |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.67E+00 | 4.79E+00 | 4.69E+00 | 4.48E+00 | 4.62E+00 | 4.23E+00 | 4.72E+00 | 4.21E+00 |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.12E+01 | 1.02E+01 | 1.10E+01 | 1.04E+01 | 9.52E+00 | 1.04E+01 | 1.03E+01 | 1.01E+01 |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 9.46E+00 | 1.07E+01 | 1.06E+01 | 1.03E+01 | 8.60E+00 | 8.29E+00 | 8.43E+00 | 8.76E+00 |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.06E+01 | 1.20E+01 | 1.13E+01 | 1.02E+01 | 1.09E+01 | 1.05E+01 | 1.11E+01 | 1.11E+01 |
| Iodine-131 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.47E+02 | 6.94E+02 | 6.52E+02 | 6.88E+02 | 2.02E+02 | 2.05E+02 | 2.71E+02 | 2.53E+02 |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.37E+00 | 3.58E+00 | 3.41E+00 | 3.17E+00 | 3.54E+00 | 3.41E+00 | 3.51E+00 | 3.59E+00 |
| Cesium-137 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.64E+00 | 3.49E+00 | 3.95E+00 | 4.00E+00 | 3.95E+00 | 3.61E+00 | 3.89E+00 | 3.91E+00 |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.06E+01 | 4.10E+01 | 3.94E+01 | 3.64E+01 | 4.03E+01 | 4.08E+01 | 3.99E+01 | 3.99E+01 |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.16E+01 | 1.13E+01 | 1.12E+01 | 9.99E+00 | 1.12E+01 | 1.20E+01 | 1.15E+01 | 1.14E+01 |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 9.47E+00 | 8.26E+00 | 9.37E+00 | 8.03E+00 | 9.17E+00 | 9.97E+00 | 9.15E+00 | 8.80E+00 |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.25E+01 | 2.29E+01 | 2.10E+01 | 2.04E+01 | 2.27E+01 | 2.15E+01 | 2.24E+01 | 2.08E+01 |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.27E+00 | 8.00E+00 | 8.04E+00 | 7.48E+00 | 7.93E+00 | 8.27E+00 | 8.21E+00 | 8.01E+00 |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.62E+00 | 8.27E+00 | 8.73E+00 | 8.37E+00 | 8.20E+00 | 8.61E+00 | 1.06E+01 | 9.33E+00 |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.04E+02 | 1.04E+02 | 1.04E+02 | 9.70E+01 | 1.08E+02 | 1.07E+02 | 1.02E+02 | 1.02E+02 |

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# Radiological Monitoring of Surface Water Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 09/05/06 | 09/05/06 | 09/05/06 | 09/05/06 | 10/02/06 | 10/02/06 | 10/02/06 | 10/02/06 |
| Tritium | (pCi/L) | 1.83E+05 | 3.28E+03 | 4.75E+02 | 6.30E+02 | 1.90E+05 | 2.45E+03 | 5.00E+02 | 5.65E+02 |
| ±2 | (sigma) | 1.20E+03 | 1.80E+02 | 1.03E+02 | 1.09E+02 | 1.22E+03 | 1.61E+02 | 1.04E+02 | 1.07E+02 |
| Gross Alpha | (pCi/L) | <LLD | <LLD | 4.56E+00 | 1.08E+01 | <MDA | <MDA | <LLD | 8.68E+00 |
| ±2 | (sigma) | | | 1.46E+00 | 2.19E+00 | | | | 2.02E+00 |
| LLD | (pCi/L) | 1.98E+00 | 1.78E+00 | 1.63E+00 | 1.87E+00 | 1.95E+00 | 2.02E+00 | 1.84E+00 | 2.00E+00 |
| Gross Non-volatile Beta | (pCi/L) | 1.05E+01 | <LLD | <LLD | 2.76E+00 | 9.61E+00 | <MDA | 2.63E+00 | 4.88E+00 |
| ±2 | (sigma) | 1.91E+00 | | | 1.56E+00 | 1.74E+00 | | 1.35E+00 | 1.54E+00 |
| LLD | (pCi/L) | 2.63E+00 | 2.61E+00 | 2.60E+00 | 2.62E+00 | 2.27E+00 | 2.28E+00 | 2.27E+00 | 2.28E+00 |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | pCi/L) | 6.91E+01 | 7.60E+01 | 8.02E+01 | 8.43E+01 | 6.66E+01 | 6.85E+01 | 6.92E+01 | 7.06E+01 |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.042E+00 | 3.35E+00 | 3.58E+00 | 2.65E+00 | 2.913E+00 | 3.25E+00 | 3.39E+00 | 3.12E+00 |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.562E+01 | 7.10E+01 | 6.92E+01 | 7.32E+01 | 6.739E+01 | 6.79E+01 | 6.89E+01 | 7.22E+01 |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.68E+00 | 3.97E+00 | 3.85E+00 | 3.56E+00 | 3.53E+00 | 3.88E+00 | 3.35E+00 | 3.96E+00 |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 5.37E+00 | 7.27E+00 | 6.37E+00 | 6.83E+00 | 5.39E+00 | 5.75E+00 | 6.41E+00 | 6.54E+00 |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.96E+00 | 2.96E+00 | 3.39E+00 | 3.52E+00 | 3.00E+00 | 3.05E+00 | 3.04E+00 | 3.04E+00 |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.76E+00 | 7.08E+00 | 7.71E+00 | 7.88E+00 | 7.67E+00 | 5.88E+00 | 7.49E+00 | 7.46E+00 |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.74E+00 | 4.98E+00 | 5.21E+00 | 3.53E+00 | 3.85E+00 | 3.89E+00 | 3.70E+00 | 4.47E+00 |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.06E+01 | 1.28E+01 | 1.30E+01 | 1.48E+01 | 1.37E+01 | 1.18E+01 | 1.21E+01 | 1.22E+01 |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.22E+01 | 1.39E+01 | 1.33E+01 | 1.36E+01 | 1.13E+01 | 1.06E+01 | 1.16E+01 | 1.20E+01 |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.04E+01 | 1.18E+01 | 1.10E+01 | 1.18E+01 | 1.19E+01 | 1.15E+01 | 1.06E+01 | 1.11E+01 |
| Iodine-131 | (pCi/L) | * | * | * | * | * | * | * | * |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | | | | | | | | |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.93E+00 | 3.97E+00 | 3.59E+00 | 3.71E+00 | 3.66E+00 | 3.24E+00 | 3.35E+00 | 3.46E+00 |
| Cesium-137 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.67E+00 | 3.66E+00 | 3.81E+00 | 3.68E+00 | 3.72E+00 | 3.54E+00 | 3.98E+00 | 3.86E+00 |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.81E+01 | 4.23E+01 | 4.29E+01 | 4.28E+01 | 3.84E+01 | 4.07E+01 | 4.16E+01 | 4.05E+01 |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.06E+01 | 1.18E+01 | 1.18E+01 | 1.14E+01 | 1.19E+01 | 1.12E+01 | 1.18E+01 | 1.20E+01 |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.28E+00 | 9.09E+00 | 9.70E+00 | 7.18E+00 | 7.94E+00 | 8.91E+00 | 9.20E+00 | 8.44E+00 |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.96E+01 | 2.26E+01 | 2.24E+01 | 2.26E+01 | 2.19E+01 | 2.24E+01 | 2.16E+01 | 2.26E+01 |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.19E+00 | 8.43E+00 | 8.16E+00 | 8.15E+00 | 8.14E+00 | 8.11E+00 | 8.00E+00 | 8.21E+00 |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.77E+00 | 9.02E+00 | 8.77E+00 | 9.40E+00 | 8.96E+00 | 9.10E+00 | 8.31E+00 | 8.27E+00 |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 9.36E+01 | 8.70E+01 | 1.03E+02 | 1.03E+02 | 1.03E+02 | 1.04E+02 | 1.05E+02 | 1.06E+02 |

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# Radiological Monitoring of Surface Water Supplemental Sample Data

| Surface Water Location: | | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 | RWSV-2045 | RWSV-2069 | RWSV-2071 | RWSV-2073 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 11/06/06 | 11/06/06 | 11/06/06 | 11/06/06 | 12/04/06 | 12/04/06 | 12/04/06 | 12/04/06 |
| Tritium | (pCi/L) | 1.92E+05 | 2.78E+03 | 7.13E+02 | 7.16E+02 | 1.66E+05 | 2.38E+03 | 5.20E+02 | 6.46E+02 |
| ±2 | (sigma) | 1.23E+03 | 1.67E+02 | 1.07E+02 | 1.07E+02 | 1.13E+03 | 1.58E+02 | 1.03E+02 | 1.08E+02 |
| Gross Alpha | (pCi/L) | 2.86E+00 | <MDA | 1.13E+01 | 5.16E+00 | <MDA | <MDA | 2.45E+00 | 3.57E+00 |
| ±2 | (sigma) | 1.29E+00 | | 2.09E+00 | 1.55E+00 | | | 1.34E+00 | 1.65E+00 |
| LLD | (pCi/L) | 1.49E+00 | 1.57E+00 | 1.34E+00 | 1.42E+00 | 2.16E+00 | 2.23E+00 | 1.98E+00 | 2.31E+00 |
| Gross Non-volatile Beta | (pCi/L) | 1.98E+01 | <MDA | 5.56E+01 | 4.07E+00 | 2.16E+01 | <MDA | <MDA | <MDA |
| ±2 | (sigma) | 2.74E+00 | | 3.78E+00 | 2.14E+00 | 2.87E+00 | | | |
| LLD | (pCi/L) | 3.85E+00 | 3.86E+00 | 3.83E+00 | 3.84E+00 | 4.06E+00 | 4.06E+00 | 4.04E+00 | 4.07E+00 |
| Beryllium-7 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | pCi/L) | 5.26E+01 | 5.26E+01 | 5.20E+01 | 5.37E+01 | 5.24E+01 | 5.33E+01 | 5.01E+01 | 5.43E+01 |
| Sodium-22 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.540E+00 | 2.87E+00 | 2.68E+00 | 2.76E+00 | 1.869E+00 | 2.22E+00 | 2.13E+00 | 1.93E+00 |
| Potassium-40 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.071E+01 | 7.31E+01 | 7.22E+01 | 7.28E+01 | 3.600E+01 | 3.11E+01 | 3.37E+01 | 3.08E+01 |
| Manganese-54 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.16E+00 | 3.09E+00 | 3.34E+00 | 3.21E+00 | 2.45E+00 | 2.05E+00 | 2.19E+00 | 1.99E+00 |
| Cobalt-58 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 4.49E+00 | 4.54E+00 | 4.61E+00 | 4.89E+00 | 4.39E+00 | 4.44E+00 | 4.12E+00 | 4.16E+00 |
| Cobalt-60 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.55E+00 | 2.78E+00 | 2.82E+00 | 2.81E+00 | 1.52E+00 | 2.06E+00 | 1.81E+00 | 1.81E+00 |
| Zinc-65 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.05E+00 | 6.83E+00 | 6.64E+00 | 7.17E+00 | 4.87E+00 | 4.98E+00 | 4.74E+00 | 5.12E+00 |
| Yitrium-88 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.24E+00 | 3.40E+00 | 2.90E+00 | 3.16E+00 | 3.21E+00 | 3.12E+00 | 3.35E+00 | 3.50E+00 |
| Zirconium-95 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.80E+00 | 8.86E+00 | 8.81E+00 | 8.99E+00 | 8.33E+00 | 8.17E+00 | 9.59E+00 | 9.17E+00 |
| Ruthenium-103 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 7.56E+00 | 7.49E+00 | 7.76E+00 | 8.32E+00 | 8.16E+00 | 9.76E+00 | 8.95E+00 | 8.89E+00 |
| Antimony-125 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.02E+01 | 1.03E+01 | 1.03E+01 | 1.04E+01 | 5.46E+00 | 5.01E+00 | 5.53E+00 | 6.02E+00 |
| Iodine-131 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | * | * | * | * |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 2.83E+02 | 2.84E+02 | 2.96E+02 | 3.01E+02 | | | | |
| Cesium-134 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.19E+00 | 3.17E+00 | 3.13E+00 | 3.31E+00 | 1.74E+00 | 2.09E+00 | 2.13E+00 | 2.13E+00 |
| Cesium-137 | (pCi/L) | 1.14E+01 | <MDA | <MDA | <MDA | 8.79E+00 | <MDA | <MDA | <MDA |
| ±2 | (sigma) | 4.00E+00 | | | | 2.24E+00 | | | |
| MDA | (pCi/L) | 3.36E+00 | 3.35E+00 | 3.58E+00 | 3.33E+00 | 1.95E+00 | 1.99E+00 | 1.99E+00 | 1.91E+00 |
| Cerium-144 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 3.84E+01 | 4.01E+01 | 3.94E+01 | 3.99E+01 | 1.80E+01 | 1.99E+01 | 1.86E+01 | 1.96E+01 |
| Europium-152 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.15E+01 | 1.12E+01 | 1.12E+01 | 1.18E+01 | 5.83E+00 | 5.77E+00 | 5.97E+00 | 6.30E+00 |
| Europium-154 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 6.94E+00 | 7.84E+00 | 7.36E+00 | 7.59E+00 | 4.13E+00 | 4.13E+00 | 4.37E+00 | 4.53E+00 |
| Europium-155 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.71E+01 | 1.72E+01 | 1.72E+01 | 1.77E+01 | 7.49E+00 | 7.67E+00 | 7.53E+00 | 7.69E+00 |
| Lead-212 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.14E+00 | 8.22E+00 | 8.25E+00 | 8.34E+00 | 4.19E+00 | 4.02E+00 | 4.08E+00 | 4.03E+00 |
| Lead-214 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 8.18E+00 | 8.66E+00 | 8.48E+00 | 1.02E+01 | 4.86E+00 | 4.65E+00 | 4.81E+00 | 4.83E+00 |
| Radium-226 | (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| ±2 | (sigma) | | | | | | | | |
| MDA | (pCi/L) | 1.07E+02 | 1.05E+02 | 1.07E+02 | 1.09E+02 | 6.18E+01 | 5.69E+01 | 5.78E+01 | 5.86E+01 |

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## 2.4 Nonradiological Monitoring of Surface Water

### 2.4.1 Summary

The streams located on the Savannah River Site (SRS) receive treated wastewater and nonpoint source runoff from on-site facilities. Recent and historical data from SRS Environmental Reports indicate that the SRS surface waters are in accordance with Freshwaters Standard guidelines stated in the South Carolina Department of Health and Environmental Control (SCDHEC) Water Classifications and Standards (Regulation 61-68), (SCDHEC 2006).

The Environmental Surveillance Oversight Program (ESOP) assessed the surface water quality for nonradiological parameters in 2006 on SRS by sampling the on-site streams for inorganic and organic contaminants. Specific parameters were analyzed monthly semi-annually, and annually. Sampling locations were strategically chosen to monitor ambient surface water conditions to detect the nonradiological impact from the Department of Energy – Savannah River (DOE-SR) operations.

Water quality on the SRS for nonradiological parameters meets the Freshwaters Standard for South Carolina streams. As in previous years, all but two of the surface water parameters, nitrate and pH, continued to be within expected ranges for South Carolina streams. Nitrate concentrations from the Four Mile Creek (SV-326) sample location were higher than comparable South Carolina streams. These elevated nitrate concentrations possibly result from wastewater treatment facility discharges into Four Mile Creek upstream from this location. Also, surface water pH from one of the Upper Three Runs (SV-2027) sample locations continues to be lower than typical South Carolina streams. This trend is typical for blackwater streams, such as Upper Three Runs. Data from ESOP surface water locations were compared to DOE-SR data where sample points were colocated. There were no notable differences between the ESOP and DOE-SR surface water data.

**RESULTS AND DISCUSSION**

ESOP field personnel recorded pH at each sample location during each sampling event. All surface water data can be found in section 2.4.4. The Freshwaters pH standard for South Carolina is between 6.0 and 8.5 (SCDHEC 1998). Measurements below the standard range for pH were observed at Upper Three Runs (SV-2027), which is the background location not typically affected by SRS operations. Low pH is typical for black water streams such as Upper Three Runs (USGS 2000).

Nitrate/nitrite concentrations above the State average of 0.639 mg/L (SCDHEC 1998) were observed from monthly samples collected at the Four Mile Creek (SV-326) location (Figure 1, section 2.4.3). The average nitrate/nitrite concentration at the Four Mile Creek location (SV-

326) was 1.899 ± 1.579 mg/L, which increased from the 2005 average of 1.430 ± 0.064 mg/L (SCDHEC 2006c).

The elevated nitrate/nitrite level may be explained by the wastewater treatment plant, which is located upstream from the sampling location, or from groundwater beneath F-Area and H-Area seepage basins outcropping into Four Mile Creek (RAC 1999). However, the observed levels of

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nitrate/nitrite are still below the 10 mg/L Maximum Contaminant Level (MCL) (U.S. EPA 1996). Two additional sampling locations will be added in 2007 to better understand the source of the elevated nitrate/nitrite levels.

The DOE-SR surface water sample location FM-6 on Four Mile Creek is located approximately four miles downstream from the ESOP surface water sample location (SV-326). The DOE-SR average nitrate/nitrite concentration for this location in 2006 was 0.61 ± 0.35 mg/L. As shown in Figure 1, DOE-SR nitrate/nitrite levels for Four Mile Creek have been consistently below ESOP nitrate/nitrite levels.

ESOP field personnel collected surface water samples for fecal coliform analysis at each location during each sampling event. The freshwaters fecal coliform standard for South Carolina is: five consecutive samples during any 30 day period shall not exceed a geometric mean of 200 colonies/100 mL membrane fecal coliform (MFC); nor shall more than ten percent of the total samples during any 30 day period exceed 400 colonies/100mL MFC (SCDHEC 2006a). Since ESOP does not collect samples every day of the month, this standard cannot accurately be used to analyze the results for this parameter. However, none of the locations had a yearly average for fecal coliform that exceeded 400 colonies/100mL MFC.

Samples analyzed for other parameters (including but not limited to alkalinity, metals, total organic carbon, volatile organic compounds, pesticides and polychlorinated biphenyl) indicated that the SRS streams met the established freshwater standards during this study (SCDHEC 2006a). All surface water data are located in section 2.4.4. Surface water statistical analyses can be found in section 2.4.5.

ESOP and DOE-SR (WSRC 2007) data comparison for the four colocated sample locations for 2006 are found in section 2.4.4. The data comparison includes yearly averages, yearly observed maximums, yearly minimums, and yearly standard deviations. At ESOP site SV-2027, which is located on Upper Three Runs, pH (5.45 ± 0.81 su), dissolved oxygen (8.93 ± 0.70 mg/L), water temperature (15.9 ± 4.1 Cº), total suspended solids (6.96 ± 14.31 mg/L), nitrate/nitrite levels (0.233 ± 0.025 mg/L). All detected metals were within one standard deviation of DOE-SR site U3R-1A, which is located approximately 1.3 miles from SV-2027. Total phosphorus (0.031 ± 0.006 mg/L) was within two standard deviations.

At ESOP site SV-324, which is located on Tims Branch, pH (6.20 ± 0.48 su), dissolved oxygen (12.98 ± 9.32 mg/L), water temperature (16.2 ± 6.1 Cº), nitrate/nitrite levels (0.144 ± 0.195 mg/L), total suspended solids (7.96 ± 16.01 mg/L), and iron (2.13 ± 0.90 mg/L) were within one standard deviation of DOE-SR site TB-5. Total organic carbon (3.2 ± 1.4 mg/L) was within two. Manganese (0.042 ± 0.011 mg/L) and total phosphorus (0.045 ± 0.015 mg/L) were within three standard deviations.

At ESOP site SV-325, which is located on Upper Three Runs, pH (6.65 ± 0.77 su), dissolved oxygen (9.18 ± 0.89 mg/L), water temperature (16.5 ± 5.3 Cº), total suspended solids (6.15 ± 9.05 mg/L), total phosphorus (0.063 ± 0.086 mg/L) iron (0.49 ± 0.16 mg/L), manganese (0.017 ± 0.006 mg/L), and zinc (1.76 ± 2.47 mg/L) were within one standard deviation of DOE-SR site

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U3R-4. Nitrate/nitrite levels (0.347 ± 0.715 mg/L) and total organic carbon (3.10 ± 0.10 mg/L) were within two standard deviations.

At ESOP site SV-327, which is located on Steel Creek, pH (6.98 ± 0.28 su), dissolved oxygen (9.06 ± 1.47 mg/L), water temperature (16.2 ± 5.7 Cº), total suspended solids (3.51 ± 4.94 mg/L) nitrate/nitrite levels (0.112 ± 0.104 mg/L), total phosphorus (0.072 ± 0.097 mg/L), iron (0.75 ± 0.47 mg/L), and manganese (0.103 ± 0.094 mg/L) were within one standard deviation of DOE-SR site SC-4. Total organic carbon (3.8 ± 1.1 mg/L) was within two, and zinc (0.034 ± 0.0 mg/L) was within three standard deviations.

## CONCLUSIONS/RECOMMENDATIONS

All parameters that were analyzed by both DOE-SR and ESOP were within three standard deviations of the ESOP average. The greater variations may be due to the locations being sampled at different times, which could have been affected by stream flow and weather patterns.

Measurements of pH, ranging from 3.66 to 6.68, were observed at the Upper Three Runs (SV-2027) sample location, a background location not typically affected by SRS operations. DOE-SR reported that the pH indicated normal trends for a southern pine forest stream (WSRC 2002). ESOP nitrate/nitrite concentrations from Four Mile Creek (SV-326) were higher than the average nitrate/nitrite levels measured at the other seven locations. These higher nitrate/nitrite levels are a possible result of discharge from the wastewater treatment plant (WSRC 2001a) or may be a result of seepage from F- and H-Areas (U.S.NRC 2007). Additional sampling will be conducted in 2007 below F-and H-Areas seepage basins and above the treatment plant in an effort to determine the source of nitrate/nitrite. The maximum nitrate/nitrite concentration observed at SV-326 during 2006 was 6.0 mg/L, with an average concentration of 1.899 mg/L for all 2006 samples collected. All sample results were below the United States Environmental Protection Agency National Primary Drinking Water Standard MCL of 10 mg/L for nitrate/nitrite concentrations (U.S. EPA 1996). Overall, the nonradiological water quality on the SRS compares favorably with the South Carolina Freshwaters Standard for the parameters and locations monitored in this study.

South Carolina state averages are from the Summary of Selected Water Quality Parameter Concentrations in South Carolina Water and Sediments (SCDHEC 1998). The state averages will continue to be used as comparison data.

ESOP will continue the nonradiological independent monitoring and surveillance of SRS surface water to verify and validate water quality. Continued monitoring is required because of increased land disturbance from accelerated clean-up, new facility construction, logging, and the potential for new emissions. The future locations, numbers of samples, sample frequencies and monitoring parameters may change to maximize available resources and address critical issues.

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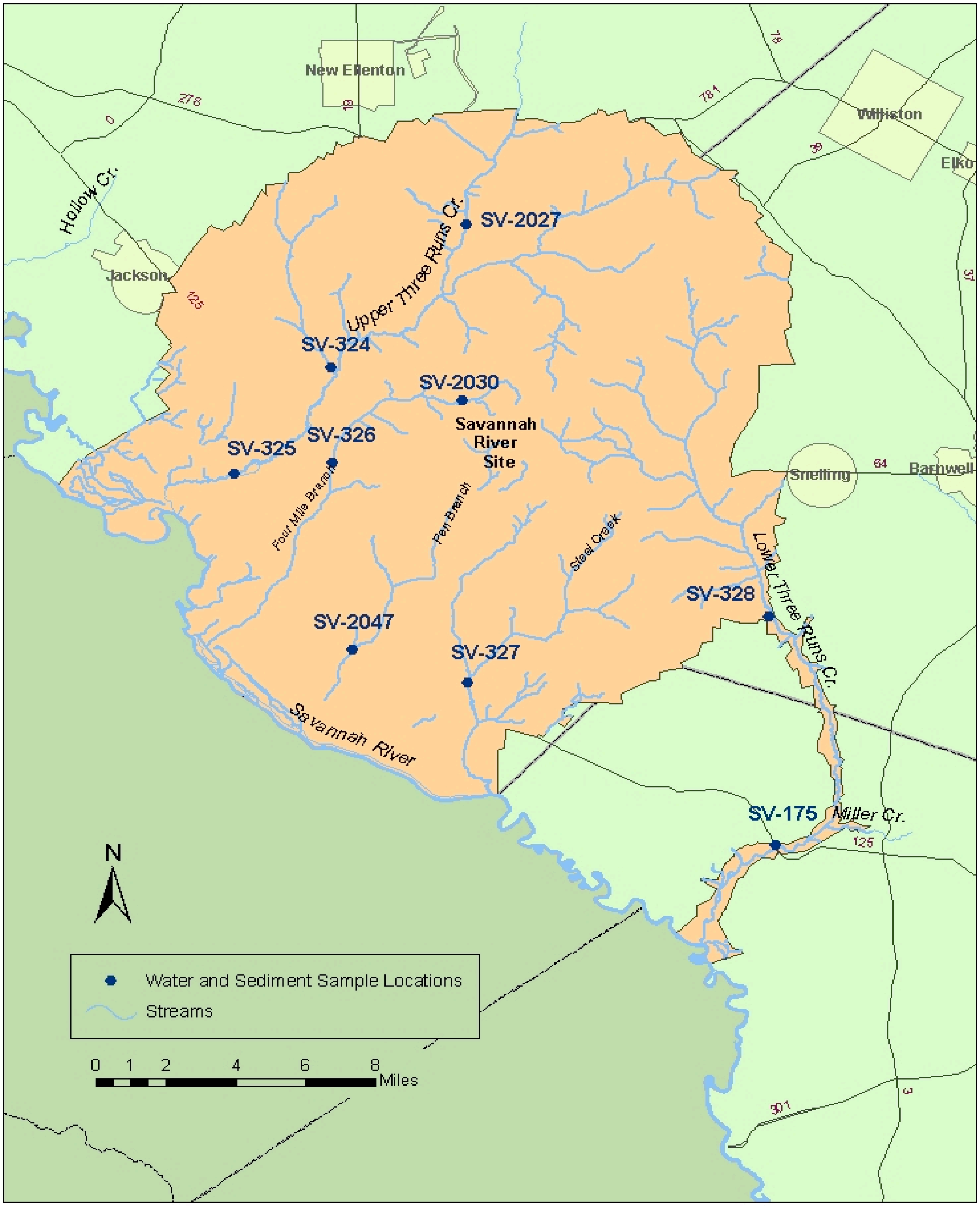
## 2.4.2
## Map 6. Nonradiological Monitoring of Surface Water Sample Locations

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## 2.4.3 Tables and Figures
## Nonradiological Monitoring of Surface Water

Table 1. DOE-SR Surface Water Sample Locations

| SRS Stream Locations * = colocated with ESOP locations | Savannah River Locations |
|---|---|
| Tinker Creek near Northeast SRS Boundary | River Mile 160 |
| *Tims Branch at Road C | River Mile 150.4 |
| ***Upper Three Runs at Road 1-A** | River Mile 141.5 |
| *Upper Three Runs at Road A | River Mile 129.1 |
| Beaver Dam Creek at D-Area | River Mile 118.8 |
| Four Mile Creek at Road E | |
| Four Mile Creek at Road C | |
| Four Mile Creek adjacent to D-Area | |
| Pen Branch at Road A-13.2 | |
| *Steel Creek at Road A | |
| Lower Three Runs at Patterson Mill Rd. | |

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## Tables and Figures
## Nonradiological Monitoring of Surface Water

Table 2. ESOP Surface Water Sample Locations

| Sample Location | Location Description | Location Rationale |
|---|---|---|
| SV-2027 | Upper Three Runs at Road 2-1 | Background sample |
| SV-324 | Tims Branch at Road C | Downstream from M- & A-Areas |
| SV-326 | Four Mile Creek at Road A-7 | Downstream from F- & H-Areas |
| SV-325 | Upper Three Runs at Road A | Downstream from F-Area |
| SV-2047 | Pen Branch at Road A-13.2 | Downstream from K-Area |
| SV-327 | Steel Creek at Road A | Downstream from L-Lake |
| SV-175 | Lower Three Runs at Highway 125 | Downstream from PAR Pond |
| SV-328 | Lower Three Runs at Patterson Mill | Downstream from PAR Pond |

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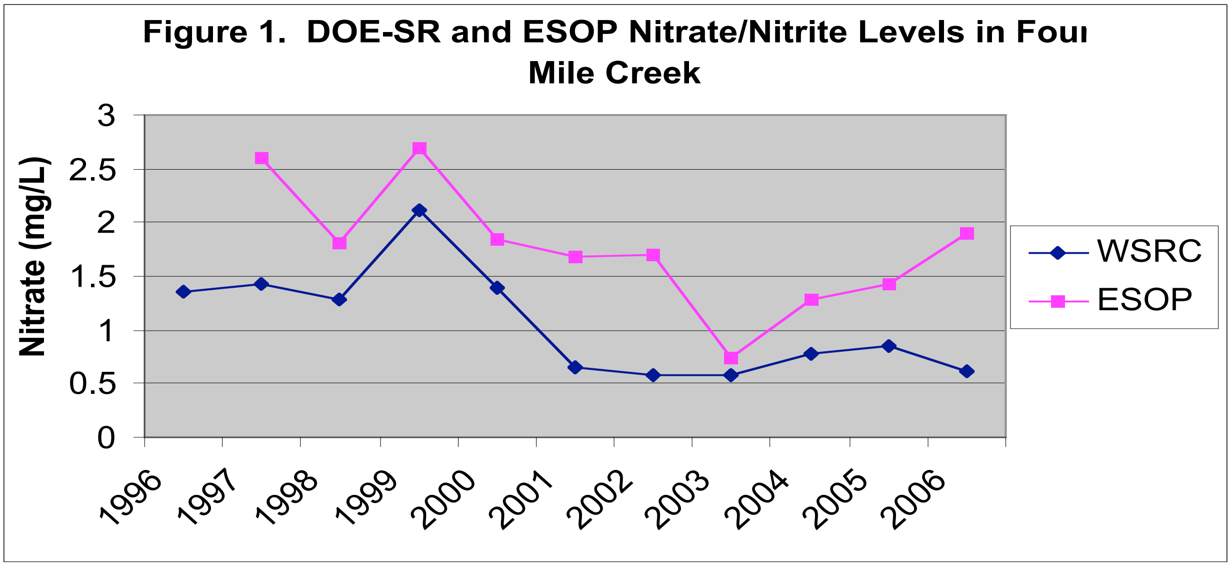
## Tables and Figures
## Nonradiological Monitoring of Surface Water

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### 2.4.4 Data
### Nonradiological Monitoring of Surface Water Data



Notes:

1. "AE" is "Analytical Error"
2. "NS" is "No Sample"
3. "e" is "Estimate"

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-2027 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly Parameters | pH | su | 3.66 | 5.29 | 4.84 | 6.68 | 4.69 | 5.17 |
| | DO | mg/L | 8.90 | 9.69 | 9.56 | 8.80 | 8.84 | AE |
| | Water Temperature | celsius | 13.7 | 12.9 | 11.2 | 17.9 | 16.1 | 21.3 |
| | Alkalinity | mg/L | <1.0 | <1.0 | <1.0 | 1.2 | <1.0 | <1.0 |
| | Turbidity | NTU | 3.3 | 1.1 | 5.7 | 1.5 | 3.4 | 3.2 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | 1.30 | 4.80 | 50.00 | 3.90 | 1.70 | 2.70 |
| | Fecal Coliform (MFC) | FC/100mL | 100 | 260 | 600 e | 160 | 90 | 540 |
| | NH3 NH4 | mg/L | 0.150 | 0.250 | 0.180 | 0.210 | <0.050 | 0.100 |
| | NO3 NO2 | mg/L | 0.250 | AE | 0.190 | 0.260 | 0.270 | 0.200 |
| | TKN | mg/L | 0.22 | AE | 0.36 | 0.31 | 0.16 | <0.10 |
| | Total Phosphorus | mg/L | 0.032 | <0.020 | AE | <0.020 | 0.036 | 0.024 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | AE | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.28 | NS | NS | 0.43 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | <2.0 | NS | NS | <2.0 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly Parameters | pH | su | 6.17 | 5.75 | 5.65 | 6.10 | 5.26 | 6.08 |
| | DO | mg/L | 8.12 | 7.84 | 8.14 | 10.09 | 9.23 | 8.98 |
| | Water Temperature | celsius | 21.1 | 21.5 | 18.8 | 12.5 | 13.9 | 9.9 |
| | Alkalinity | mg/L | <1.0 | <1.0 | 1.4 | 1.4 | 1.4 | <1.0 |
| | Turbidity | NTU | 1.3 | 4.9 | 1.3 | <1.0 | <1.0 | 2.0 |
| | BOD | mg/L | <2.0 | 3.6 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 3.10 | 3.20 | <0.50 | 1.90 | 1.60 | 2.40 |
| | Fecal Coliform (MFC) | FC/100mL | 93 | 810 | 48 | 130 | 83 | 64 |
| | NH3 NH4 | mg/L | AE | 0.140 | <0.050 | <0.050 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.210 | 0.240 | 0.240 | 0.220 | 0.240 | 0.240 |
| | TKN | mg/L | <0.10 | 0.20 | 0.18 | 0.10 | 0.28 | 0.12 |
| | Total Phosphorus | mg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.28 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | 0.016 | NS | NS | NS | NS | NS |
| | TOC | mg/L | <2.0 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-324 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly | pH | su | 5.82 | 6.02 | 5.36 | 6.73 | 5.65 | 6.02 |
| Parameters | DO | mg/L | 10.07 | 10.63 | 10.39 | 9.31 | 9.57 | AE |
| | Water Temperature | celsius | 12.0 | 11.2 | 9.8 | 18.6 | 16.5 | 22.6 |
| | Alkalinity | mg/L | 5.8 | 5.7 | 4.0 | 9.2 | 7.8 | 8.8 |
| | Turbidity | NTU | 2.9 | 2.8 | 6.9 | 4.6 | 6.9 | 5.8 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | 1.30 | 3.30 | 56.00 | 3.50 | 4.70 | 6.80 |
| | Fecal Coliform (MFC) | FC/100mL | 120 | 120 | 600 e | 170 | 270 | 260 |
| | NH3 NH4 | mg/L | 0.180 | 0.210 | 0.170 | 0.240 | <0.050 | 0.170 |
| | NO3 NO2 | mg/L | 0.120 | AE | 0.160 | 0.120 | 0.085 | 0.720 |
| | TKN | mg/L | 0.23 | AE | 0.51 | 0.50 | 0.14 | 0.18 |
| | Total Phosphorus | mg/L | 0.027 | <0.020 | 0.073 | 0.062 | 0.048 | 0.050 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | AE | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 1.10 | NS | NS | 2.70 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.034 | NS | NS | <0.010 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | 2.5 | NS | NS | 4.9 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly | pH | su | 6.56 | 6.11 | 6.17 | 6.33 | 6.19 | 7.08 |
| Parameters | DO | mg/L | 8.51 | 8.23 | 39.28 | 12.55 | 10.98 | 10.37 |
| | Water Temperature | celsius | 24.3 | 24.1 | 20.1 | 11.1 | 12.4 | 7.7 |
| | Alkalinity | mg/L | 9.3 | 6.2 | 30.0 | 5.7 | 5.8 | 4.1 |
| | Turbidity | NTU | 6.2 | 5.5 | 3.2 | 2.1 | 1.9 | 3.3 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 4.20 | 1.50 | 2.10 | 2.00 | 2.20 | 1.30 |
| | Fecal Coliform (MFC) | FC/100mL | 240 | 680 | 360 | 300 | 100 | 54 |
| | NH3 NH4 | mg/L | AE | 0.110 | <0.050 | 0.073 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.060 | 0.072 | 0.069 | 0.025 | 0.054 | 0.100 |
| | TKN | mg/L | 0.20 | 0.13 | 0.35 | <0.10 | 0.37 | 0.32 |
| | Total Phosphorus | mg/L | 0.053 | 0.034 | 0.044 | 0.028 | 0.048 | 0.026 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 2.60 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.050 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 2.3 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-326 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly Parameters | pH | su | 6.68 | 5.97 | 5.32 | 6.93 | 6.09 | 6.37 |
| | DO | mg/L | 10.35 | 10.41 | 9.68 | 7.76 | 7.59 | AE |
| | Water Temperature | celsius | 11.7 | 10.8 | 10.2 | 19.5 | 16.2 | 23.8 |
| | Alkalinity | mg/L | 16.0 | 13.0 | 8.1 | 21.0 | 22.0 | 25.0 |
| | Turbidity | NTU | 3.8 | 3.1 | 14.0 | 5.0 | 5.7 | 4.7 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | 1.00 | 2.60 | 51.00 | 1.20 | 1.20 | 3.10 |
| | Fecal Coliform (MFC) | FC/100mL | 150 | 180 | 600 e | 460 | 510 | 500 |
| | NH3 NH4 | mg/L | 0.150 | 0.140 | 0.230 | 0.270 | <0.050 | 0.230 |
| | NO3 NO2 | mg/L | 1.300 | AE | 0.840 | 1.200 | 2.800 | 3.000 |
| | TKN | mg/L | 0.30 | AE | 0.63 | 0.64 | 0.30 | 0.28 |
| | Total Phosphorus | mg/L | 0.170 | 0.140 | 0.150 | 0.180 | 0.270 | 0.320 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | AE | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.73 | NS | NS | 1.80 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.056 | NS | NS | 0.098 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | 0.014 | NS | NS | 0.026 | NS | NS |
| | TOC | mg/L | 3.9 | NS | NS | 5.8 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly Parameters | pH | su | 7.10 | 6.77 | 6.64 | 6.92 | 6.69 | 7.12 |
| | DO | mg/L | 5.75 | 4.56 | 5.62 | 8.32 | 8.89 | 9.36 |
| | Water Temperature | celsius | 26.2 | 25.4 | 20.5 | 12.0 | 11.5 | 6.0 |
| | Alkalinity | mg/L | 45.0 | 3.5 | 25.0 | 22.0 | 18.0 | 13.0 |
| | Turbidity | NTU | 4.2 | 4.1 | 2.2 | 2.3 | 2.0 | 9.9 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 1.30 | 1.60 | 1.50 | <0.50 | 1.00 | 1.90 |
| | Fecal Coliform (MFC) | FC/100mL | 500 | 240 | 31 | 200 | 250 | 76 |
| | NH3 NH4 | mg/L | 0.290 | 0.083 | 0.066 | <0.050 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 6.000 | 0.150 | 1.400 | 1.400 | 1.600 | 1.200 |
| | TKN | mg/L | 0.57 | <0.10 | 0.34 | 0.30 | 0.52 | 0.34 |
| | Total Phosphorus | mg/L | 0.670 | 0.028 | 0.210 | 0.180 | 0.140 | 0.110 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 1.10 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.087 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | 0.025 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 4.9 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-325 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly | pH | su | 6 | 6.29 | 5.51 | 7.19 | 5.68 | 6.17 |
| Parameters | DO | mg/L | 9.21 | 10.10 | 9.04 | 8.50 | 9.07 | AE |
| | Water Temperature | celsius | 13.13 | 11.3 | 11.5 | 19.1 | 16.7 | 22.4 |
| | Alkalinity | mg/L | 2.3 | 2.8 | 2.6 | 3.5 | 3.9 | 3.0 |
| | Turbidity | NTU | 2.9 | 2.1 | 5.8 | 2.5 | 6.4 | 13.0 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | 0.7 | 4.30 | 33 | 2.80 | 1.60 | 4.60 |
| | Fecal Coliform (MFC) | FC/100mL | 93 | 110 | 600 e | 250 | 280 | 600 e |
| | NH3 NH4 | mg/L | 0.200 | 0.150 | 0.21 | 0.230 | <0.050 | 0.082 |
| | NO3 NO2 | mg/L | 0.120 | AE | 0.130 | 0.170 | 0.170 | 0.110 |
| | TKN | mg/L | 0.24 | AE | 0.43 | 0.43 | <0.10 | <0.10 |
| | Total Phosphorus | mg/L | 0.027 | <0.020 | 0.049 | 0.048 | 0.038 | 0.029 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | AE | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.38 | NS | NS | 0.68 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.019 | NS | NS | 0.022 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | 0.014 | NS | NS | 3.500 | NS | NS |
| | TOC | mg/L | 3.2 | NS | NS | 3.0 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly | pH | su | 6.84 | 6.93 | 6.36 | 7.28 | 6.68 | 8.19 |
| Parameters | DO | mg/L | 8.23 | 8.41 | 8.10 | 10.54 | 10.18 | 9.64 |
| | Water Temperature | celsius | 23.4 | 22.8 | 19.8 | 12.7 | 12.7 | 8.9 |
| | Alkalinity | mg/L | 3.9 | 30.0 | 3.8 | 4.3 | 3.4 | 1.4 |
| | Turbidity | NTU | 2.9 | 3.9 | 3.1 | 1.9 | 1.9 | 4.8 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 2.10 | 4.00 | 6.80 | 3.60 | 3.80 | 1.00 |
| | Fecal Coliform (MFC) | FC/100mL | 100 | 120 e | 600 e | 360 | 40 e | 150 |
| | NH3 NH4 | mg/L | AE | 0.120 | <0.050 | <0.050 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.140 | 2.500 | 0.190 | 0.075 | 0.120 | 0.094 |
| | TKN | mg/L | <0.10 | 0.29 | 0.48 | 0.17 | 0.20 | 0.23 |
| | Total Phosphorus | mg/L | 0.041 | 0.320 | 0.028 | 0.041 | 0.023 | 0.045 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.42 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.011 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | TOC | mg/L | <2.0 | NS | NS | NS | NS | NS |

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# Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-2047 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly Parameters | pH | su | 7.08 | 6.63 | 6.70 | 6.82 | 6.18 | 7.30 |
| | DO | mg/L | 10.24 | 9.86 | 10.84 | 9.13 | 9.60 | 8.81 |
| | Water Temperature | celsius | 12.3 | 11.3 | 10.9 | 19.1 | 15.8 | 23.0 |
| | Alkalinity | mg/L | 14.0 | 16.0 | 11.0 | 22.0 | 18.0 | 22.0 |
| | Turbidity | NTU | 5.0 | 2.7 | 7.9 | 3.9 | 5.7 | 2.8 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | 1.60 | 2.60 | 9.60 | 1.00 | 0.60 | 0.60 |
| | Fecal Coliform (MFC) | FC/100mL | 100 | 110 | 140 | 180 | 65 e | 25 e |
| | NH3 NH4 | mg/L | 0.170 | 0.170 | 0.200 | 0.220 | <0.050 | 0.077 |
| | NO3 NO2 | mg/L | 0.100 | 0.083 | 0.089 | 0.160 | 0.140 | 0.130 |
| | TKN | mg/L | 0.20 | 0.21 | 0.43 | 0.33 | <0.10 | 0.16 |
| | Total Phosphorus | mg/L | 0.036 | <0.020 | 0.027 | 0.033 | 0.058 | 0.051 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.58 | NS | NS | 1.10 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.054 | NS | NS | 0.068 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | 5.2 | NS | NS | 4.2 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly Parameters | pH | su | 7.17 | 7.19 | 7.25 | 7.69 | 7.48 | 8.95 |
| | DO | mg/L | 7.83 | 7.41 | 8.87 | 12.48 | 11.79 | 9.77 |
| | Water Temperature | celsius | 24.2 | 24.1 | 22.5 | 11.1 | 14.5 | 7.7 |
| | Alkalinity | mg/L | 24.0 | 21.0 | 22.0 | 16.0 | 18.0 | 14.0 |
| | Turbidity | NTU | 2.3 | 3.0 | 2.0 | 1.4 | 1.9 | 3.4 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 0.70 | 2.70 | 0.60 | 1.60 | 1.80 | <0.50 |
| | Fecal Coliform (MFC) | FC/100mL | 48 e | 77 | 540 | 170 | 60 | 160 |
| | NH3 NH4 | mg/L | AE | 0.061 | <0.050 | 0.190 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.100 | 0.170 | 0.130 | 0.150 | 0.120 | 0.180 |
| | TKN | mg/L | <0.10 | 0.33 | 0.43 | 0.22 | 0.27 | 0.23 |
| | Total Phosphorus | mg/L | 0.023 | 0.026 | 0.023 | 0.020 | 0.022 | <0.020 |
| Quarterly Metals and TOC | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.40 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.034 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 5.7 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-327 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly | pH | su | 6.80 | 6.85 | 6.55 | 6.82 | 6.62 | 7.22 |
| Parameters | DO | mg/L | 9.59 | 9.44 | 10.09 | 8.78 | 9.22 | 7.52 |
| | Water Temperature | celsius | 12.4 | 11.2 | 11.2 | 18.4 | 15.4 | 22.5 |
| | Alkalinity | mg/L | 17.0 | 18.0 | 13.0 | 28.0 | 22.0 | 25.0 |
| | Turbidity | NTU | 3.4 | 2.6 | 4.0 | 2.8 | 4.8 | 2.2 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | <0.50 | 15.00 | 5.80 | 1.00 | <0.50 | 0.50 |
| | Fecal Coliform (MFC) | FC/100mL | 87 | 200 | 450 | 100 e | 60 e | 100 |
| | NH3 NH4 | mg/L | 0.260 | 0.230 | 0.200 | 0.120 | 0.056 | 0.075 |
| | NO3 NO2 | mg/L | 0.055 | 0.057 | 0.079 | 0.310 | 0.093 | 0.100 |
| | TKN | mg/L | 0.37 | 0.45 | 0.25 | 4.40 | <0.10 | 0.23 |
| | Total Phosphorus | mg/L | <0.020 | 0.021 | 0.038 | 0.270 | 0.037 | 0.028 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.47 | NS | NS | 1.30 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.060 | NS | NS | 0.210 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | 0.034 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | 4.5 | NS | NS | 4.4 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly | pH | su | 7.05 | 7.19 | 6.91 | 7.24 | 7.06 | 7.50 |
| Parameters | DO | mg/L | 7.45 | 6.49 | 8.13 | 11.65 | 10.66 | 9.71 |
| | Water Temperature | celsius | 23.4 | 23.9 | 22.5 | 11.1 | 14.6 | 7.9 |
| | Alkalinity | mg/L | 28.0 | 25.0 | 25.0 | 24.0 | 23.0 | 17.0 |
| | Turbidity | NTU | 2.4 | 1.8 | 1.5 | 1.2 | 1.4 | 1.8 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | 0.90 | 1.20 | 2.30 | <0.50 | 1.40 | <0.50 |
| | Fecal Coliform (MFC) | FC/100mL | 63 | 110 | 180 | 180 | 40 | 140 |
| | NH3 NH4 | mg/L | AE | 0.100 | <0.050 | <0.050 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.090 | 0.080 | 0.056 | 0.350 | 0.025 | 0.049 |
| | TKN | mg/L | <0.10 | 0.20 | 0.23 | <0.10 | 0.31 | 0.27 |
| | Total Phosphorus | mg/L | 0.038 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.49 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.038 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 2.6 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

| Sample Location: | SV-175 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| Monthly | pH | su | 7.01 | 7.07 | 6.77 | 7.02 | 6.35 | 7.23 |
| Parameters | DO | mg/L | 8.97 | 9.39 | 9.69 | 7.24 | 9.33 | 5.97 |
| | Water Temperature | celsius | 12.3 | 11.6 | 11.0 | 19.6 | 16.0 | 23.7 |
| | Alkalinity | mg/L | 31.0 | 34.0 | 28.0 | 40.0 | 40.0 | 33.0 |
| | Turbidity | NTU | 4.9 | 2.0 | 4.4 | 2.1 | 8.5 | 2.3 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | <0.50 | 9.60 | 1.70 | <0.50 | 4.10 | 0.80 |
| | Fecal Coliform (MFC) | FC/100mL | 110 | 140 | 1200 e | 140 | 300 | 180 |
| | NH3 NH4 | mg/L | 0.180 | 0.190 | 0.150 | 0.220 | 0.081 | 0.250 |
| | NO3 NO2 | mg/L | 0.039 | 0.044 | 0.086 | 0.180 | 0.120 | 0.096 |
| | TKN | mg/L | 0.24 | 0.38 | 0.38 | 0.41 | 0.16 | 0.28 |
| | Total Phosphorus | mg/L | 0.037 | 0.020 | 0.039 | 0.055 | 0.055 | 0.053 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | 0.012 | NS | NS |
| | Iron | mg/L | 0.39 | NS | NS | 0.69 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.038 | NS | NS | 0.073 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | 6.1 | NS | NS | 4.8 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly | pH | su | 7.31 | 7.40 | 7.20 | 8.22 | 7.16 | 7.76 |
| Parameters | DO | mg/L | 7.02 | 6.58 | 6.90 | 12.92 | 10.14 | 9.51 |
| | Water Temperature | celsius | 24.1 | 24.4 | 22.1 | 11.1 | 14.6 | 8.0 |
| | Alkalinity | mg/L | 51.0 | 48.0 | 44.0 | 47.0 | 47.0 | 30.0 |
| | Turbidity | NTU | 2.4 | 1.9 | 1.5 | 1.3 | 1.1 | 2.0 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | <0.50 | 2.80 | 2.80 | 0.50 | 0.60 | 0.60 |
| | Fecal Coliform (MFC) | FC/100mL | 170 | 100 | 190 | 180 | 140 | 300 |
| | NH3 NH4 | mg/L | 0.200 | 0.090 | <0.050 | <0.050 | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.140 | 0.140 | 0.099 | 0.065 | 0.035 | 0.037 |
| | TKN | mg/L | 0.21 | 0.40 | AE | <0.10 | 0.26 | 0.40 |
| | Total Phosphorus | mg/L | 0.044 | 0.033 | 0.032 | 0.024 | <0.020 | 0.022 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.57 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.079 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | 0.013 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 3.6 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## Nonradiological Surface Water Data

Sample Location: SV-328

| Sample Date: | | units | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
|---|---|---|---|---|---|---|---|---|
| Monthly | pH | su | 6.95 | 6.95 | 6.84 | 6.95 | 6.54 | 7.38 |
| Parameters | DO | mg/L | 9.14 | 8.87 | 9.68 | 8.20 | 8.69 | 7.02 |
| | Water Temperature | celsius | 12.7 | 11.8 | 12.4 | 19.2 | 16.2 | 23.2 |
| | Alkalinity | mg/L | 28.0 | 34.0 | 28.0 | 39.0 | 43.0 | 37.0 |
| | Turbidity | NTU | 2.4 | 1.0 | 2.6 | 1.4 | 8.0 | 1.5 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| | TSS | mg/L | <0.50 | 1.20 | 1.10 | <0.50 | 21.00 | 0.60 |
| | Fecal Coliform (MFC) | FC/100mL | 100 | 150 | 390 | 100 e | 67 | 130 |
| | NH3 NH4 | mg/L | 0.220 | 0.230 | 0.230 | 0.300 | <0.050 | 0.086 |
| | NO3 NO2 | mg/L | 0.045 | 0.057 | 0.048 | 0.150 | 0.140 | 0.094 |
| | TKN | mg/L | 0.29 | 0.37 | 0.35 | 0.33 | 0.18 | <0.10 |
| | Total Phosphorus | mg/L | 0.021 | 0.022 | <0.020 | 0.069 | 0.053 | 0.045 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | Iron | mg/L | 0.24 | NS | NS | 0.67 | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | <0.00020 | NS | NS |
| | Manganese | mg/L | 0.037 | NS | NS | 0.097 | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | <0.020 | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | <0.050 | NS | NS |
| | Zinc | mg/L | <0.010 | NS | NS | <0.010 | NS | NS |
| | TOC | mg/L | 4.2 | NS | NS | 5.1 | NS | NS |
| Sample Date: | | units | Jul-06 | Aug-06 | Sep-06 | Oct-06 | Nov-06 | Dec-06 |
| Monthly | pH | su | 7.35 | 7.33 | 7.18 | 7.28 | 7.44 | 7.53 |
| Parameters | DO | mg/L | 7.18 | 6.54 | 8.33 | 10.35 | 9.44 | 9.34 |
| | Water Temperature | celsius | 22.6 | 23.2 | 21.5 | 12.3 | 15.7 | 9.2 |
| | Alkalinity | mg/L | 49.0 | 45.0 | 47.0 | 47.0 | 52.0 | 37.0 |
| | Turbidity | NTU | 1.7 | 1.6 | 1.6 | 1.8 | 1.0 | 1.2 |
| | BOD | mg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | AE |
| | TSS | mg/L | <0.50 | 0.80 | 4.00 | 1.00 | 1.40 | <0.50 |
| | Fecal Coliform (MFC) | FC/100mL | 130 | 230 | 230 | 210 | 110 | 140 |
| | NH3 NH4 | mg/L | AE | <0.050 | <0.050 | AE | <0.050 | <0.050 |
| | NO3 NO2 | mg/L | 0.130 | 0.100 | 0.110 | 0.120 | 0.052 | 0.057 |
| | TKN | mg/L | <0.10 | 0.26 | 0.30 | <0.10 | 0.18 | 0.36 |
| | Total Phosphorus | mg/L | 0.037 | 0.028 | 0.028 | 0.027 | 0.02 | <0.020 |
| Quarterly | Cadmium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| Metals | Chromium | mg/L | <0.010 | NS | NS | NS | NS | NS |
| and TOC | Copper | mg/L | <0.010 | NS | NS | NS | NS | NS |
| | Iron | mg/L | 0.48 | NS | NS | NS | NS | NS |
| | Mercury | mg/L | <0.00020 | NS | NS | NS | NS | NS |
| | Manganese | mg/L | 0.042 | NS | NS | NS | NS | NS |
| | Nickel | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | Lead | mg/L | <0.050 | NS | NS | NS | NS | NS |
| | Zinc | mg/L | <0.020 | NS | NS | NS | NS | NS |
| | TOC | mg/L | 2.4 | NS | NS | NS | NS | NS |

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## Nonradiological Monitoring of Surface Water
## ESOP and DOE-SR Data Comparison

**ESOP Sample Location:** **SV-2027**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly** | **pH** | **su** | 5.45 | 0.81 | 6.68 | 3.66 |
| **Parameters** | **DO** | **mg/L** | 8.93 | 0.70 | 10.09 | 7.84 |
| | **Water Temperature** | **celsius** | 15.9 | 4.1 | 21.5 | 9.9 |
| | **TSS** | **mg/L** | 6.96 | 14.31 | 50.00 | 1.30 |
| | **NO3 NO2** | **mg/L** | 0.233 | 0.025 | 0.270 | 0.190 |
| | **Total Phosphorus** | **mg/L** | 0.031 | 0.006 | 0.036 | 0.024 |
| **Quarterly** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **Metals** | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **and TOC** | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.33 | 0.09 | 0.43 | 0.28 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.016 | 0.000 | 0.016 | 0.016 |
| | **TOC** | **mg/L** | <LLD | <LLD | <LLD | <LLD |

**DOE-SR Sample Location:** **U3R-1A**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly** | **pH** | **su** | 6.05 | 0.46 | 6.90 | 5.30 |
| **Parameters** | **DO** | **mg/L** | 9.03 | 1.68 | 10.00 | 7.31 |
| | **Water Temperature** | **celsius** | 16.0 | 4.4 | 22.0 | 8.4 |
| | **TSS** | **mg/L** | 4.45 | 1.95 | 7.20 | 1.00 |
| | **NO3 NO2** | **mg/L** | 0.235 | 0.058 | 0.029 | 0.060 |
| | **Total Phosphorus** | **mg/L** | 0.041 | 0.037 | 0.150 | 0.015 |
| **Quarterly** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **Metals** | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **and TOC** | **Copper** | **mg/L** | 0.003 | 0.001 | 0.004 | 0.002 |
| | **Iron** | **mg/L** | 0.34 | 0.09 | 0.51 | 0.24 |
| | **Mercury** | **mg/L** | 0.022 | 0.003 | 0.027 | 0.020 |
| | **Manganese** | **mg/L** | 0.010 | 0.002 | 0.015 | 0.007 |
| | **Nickel** | **mg/L** | 0.002 | 0.000 | 0.002 | 0.002 |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.007 | 0.004 | 0.013 | 0.003 |
| | **TOC** | **mg/L** | 3.525 | 1.569 | 6.600 | 2.000 |

Notes:
1. "SU" is Standard Units
2. "mg/L" is milligrams per Liter
3. "ND" is No Detect
4. "St. Dev." is Standard Deviation

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## Nonradiological Monitoring of Surface Water
## ESOP and DOE-SR Data Comparison

**ESOP Sample Location:** **SV-324**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly Parameters** | pH | su | 6.20 | 0.48 | 7.08 | 5.36 |
| | DO | mg/L | 12.98 | 9.32 | 39.28 | 8.23 |
| | Water Temperature | celsius | 16.2 | 6.1 | 24.3 | 7.7 |
| | TSS | mg/L | 7.96 | 16.01 | 56.00 | 1.30 |
| | NO3 NO2 | mg/L | 0.144 | 0.195 | 0.720 | 0.025 |
| | Total Phosphorus | mg/L | 0.045 | 0.015 | 0.073 | 0.026 |
| **Quarterly Metals and TOC** | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Iron | mg/L | 2.13 | 0.90 | 2.70 | 1.10 |
| | Mercury | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Manganese | mg/L | 0.042 | 0.011 | 0.050 | 0.034 |
| | Nickel | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Lead | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Zinc | mg/L | <LLD | <LLD | <LLD | <LLD |
| | TOC | mg/L | 3.233 | 1.447 | 4.900 | 2.300 |

**DOE-SR Sample Location:** **TB-5**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly Parameters** | pH | su | 9.811 | 1.647 | 13.360 | 7.700 |
| | DO | mg/L | 6.440 | 0.797 | 7.800 | 4.800 |
| | Water Temperature | celsius | 16.092 | 5.759 | 23.000 | 6.300 |
| | TSS | mg/L | 7.175 | 6.627 | 22.000 | 0.500 |
| | NO3 NO2 | mg/L | 0.096 | 0.049 | 0.200 | 0.021 |
| | Total Phosphorus | mg/L | 0.081 | 0.036 | 0.140 | 0.026 |
| **Quarterly Metals and TOC** | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | 0.003 | 0.001 | 0.003 | 0.002 |
| | Iron | mg/L | 1.981 | 0.767 | 3.286 | 0.995 |
| | Mercury | mg/L | 0.021 | 0.002 | 0.023 | 0.020 |
| | Manganese | mg/L | 0.069 | 0.060 | 0.254 | 0.033 |
| | Nickel | mg/L | 0.005 | 0.002 | 0.009 | 0.003 |
| | Lead | mg/L | 0.003 | 0.000 | 0.003 | 0.003 |
| | Zinc | mg/L | 0.008 | 0.005 | 0.020 | 0.003 |
| | TOC | mg/L | 5.125 | 1.334 | 6.900 | 2.600 |

Notes:
1. "SU" is Standard Units
2. "mg/L" is milligrams per Liter
3. "ND" is No Detect
4. "St. Dev." is Standard Deviation

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## Nonradiological Monitoring of Surface Water
## ESOP and DOE-SR Data Comparison

**ESOP Sample Location:** **SV-325**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 6.65 | 0.77 | 8.19 | 5.51 |
| | **DO** | **mg/L** | 9.18 | 0.89 | 10.54 | 8.10 |
| | **Water Temperature** | **celsius** | 16.5 | 5.3 | 23.4 | 8.9 |
| | **TSS** | **mg/L** | 6.15 | 9.05 | 33.00 | 1.00 |
| | **NO3 NO2** | **mg/L** | 0.347 | 0.715 | 2.500 | 0.075 |
| | **Total Phosphorus** | **mg/L** | 0.063 | 0.086 | 0.320 | 0.023 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.493 | 0.163 | 0.680 | 0.380 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | 0.017 | 0.006 | 0.022 | 0.011 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 1.757 | 2.465 | 3.500 | 0.014 |
| | **TOC** | **mg/L** | 3.100 | 0.141 | 3.200 | 3.000 |

**DOE-SR Sample Location:** **U3R-4**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 6.06 | 1.82 | 12.00 | 0.49 |
| | **DO** | **mg/L** | 7.50 | 2.46 | 12.44 | 1.74 |
| | **Water Temperature** | **celsius** | 17.37 | 6.20 | 25.00 | 4.36 |
| | **TSS** | **mg/L** | 8.34 | 7.43 | 22.17 | 0.00 |
| | **NO3 NO2** | **mg/L** | 0.13 | 0.05 | 12.00 | 0.03 |
| | **Total Phosphorus** | **mg/L** | 0.05 | 0.03 | 12.00 | 0.02 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.472 | 0.227 | 12.000 | 0.172 |
| | **Mercury** | **mg/L** | 0.020 | 0.010 | 4.000 | 0.004 |
| | **Manganese** | **mg/L** | 0.017 | 0.007 | 12.000 | 0.006 |
| | **Nickel** | **mg/L** | 0.002 | 0.001 | 5.000 | 0.001 |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.011 | 0.009 | 10.000 | 0.004 |
| | **TOC** | **mg/L** | 4.056 | 1.529 | 12.000 | 1.051 |

Notes:
1. "SU" is Standard Units
2. "mg/L" is milligrams per Liter
3. "ND" is No Detect
4. "St. Dev." is Standard Deviation

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## Nonradiological Monitoring of Surface Water
## ESOP and DOE-SR Data Comparison

**ESOP Sample Location:** **SV-327**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly** | **pH** | **su** | 6.98 | 0.28 | 7.50 | 6.55 |
| **Parameters** | **DO** | **mg/L** | 9.06 | 1.47 | 11.65 | 6.49 |
| | **Water Temperature** | **celsius** | 16.2 | 5.7 | 23.9 | 7.9 |
| | **TSS** | **mg/L** | 3.51 | 4.94 | 15.00 | 0.50 |
| | **NO3 NO2** | **mg/L** | 0.112 | 0.104 | 0.350 | 0.025 |
| | **Total Phosphorus** | **mg/L** | 0.072 | 0.097 | 0.270 | 0.021 |
| **Quarterly** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **Metals** | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **and TOC** | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.75 | 0.47 | 1.30 | 0.47 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | 0.103 | 0.094 | 0.210 | 0.038 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.034 | 0.000 | 0.034 | 0.034 |
| | **TOC** | **mg/L** | 3.833 | 1.069 | 4.500 | 2.600 |

**DOE-SR Sample Location:** **SC-4**

| | | units | Avg. | SD | Max | Min |
|---|---|---|---|---|---|---|
| **Monthly** | **pH** | **su** | 6.56 | 2.00 | 12.00 | 0.27 |
| **Parameters** | **DO** | **mg/L** | 7.83 | 2.81 | 12.90 | 2.07 |
| | **Water Temperature** | **celsius** | 18.48 | 6.64 | 26.00 | 5.05 |
| | **TSS** | **mg/L** | 2.74 | 2.52 | 12.00 | 0.00 |
| | **NO3 NO2** | **mg/L** | 0.082 | 0.041 | 12.000 | 0.028 |
| | **Total Phosphorus** | **mg/L** | 0.058 | 0.064 | 12.000 | 0.016 |
| **Quarterly** | **Cadmium** | **mg/L** | 0.001 | 0.001 | 3.000 | 0.000 |
| **Metals** | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| **and TOC** | **Copper** | **mg/L** | 0.003 | 0.002 | 3.000 | 0.002 |
| | **Iron** | **mg/L** | 0.422 | 0.173 | 11.000 | 0.141 |
| | **Mercury** | **mg/L** | 0.020 | 0.009 | 5.000 | 0.003 |
| | **Manganese** | **mg/L** | 0.035 | 0.014 | 12.000 | 0.014 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.013 | 0.012 | 8.000 | 0.003 |
| | **TOC** | **mg/L** | 5.463 | 2.048 | 12.000 | 1.442 |

Notes:
1. "SU" is Standard Units
2. "mg/L" is milligrams per Liter
3. "ND" is No Detect
4. "St. Dev." is Standard Deviation

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## 2.4.5 Summary Statistics
## Nonradiological Monitoring of Surface Water

**Sample Location:** **SV-2027**

| | | units | Avg. | SD | Median | Max | Min | N |
|---|---|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 5.45 | 0.81 | 5.47 | 6.68 | 3.66 | 12 |
| | **DO** | **mg/L** | 8.93 | 0.70 | 8.90 | 10.09 | 7.84 | 11 |
| | **Water Temperature** | **celsius** | 15.9 | 4.1 | 15.0 | 21.5 | 9.9 | 12 |
| | **Alkalinity** | **mg/L** | 1.4 | 0.1 | 1.4 | 1.4 | 1.2 | 4 |
| | **Turbidity** | **NTU** | 2.8 | 1.6 | 2.6 | 5.7 | 1.1 | 10 |
| | **BOD** | **mg/L** | 3.6 | 0.0 | 3.6 | 3.6 | 3.6 | 1 |
| | **TSS** | **mg/L** | 6.96 | 14.31 | 2.70 | 50.00 | 1.30 | 11 |
| | **Fecal Coliform (MFC)** | **FC/100mL** | 248 | 256 | 115 | 810 | 48 | 12 |
| | **NH3 NH4** | **mg/L** | 0.172 | 0.053 | 0.165 | 0.250 | 0.100 | 6 |
| | **NO3 NO2** | **mg/L** | 0.233 | 0.025 | 0.240 | 0.270 | 0.190 | 11 |
| | **TKN** | **mg/L** | 0.21 | 0.09 | 0.20 | 0.36 | 0.10 | 9 |
| | **Total Phosphorus** | **mg/L** | 0.031 | 0.006 | 0.032 | 0.036 | 0.024 | 3 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.33 | 0.09 | 0.28 | 0.43 | 0.28 | 3 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.016 | 0.000 | 0.016 | 0.016 | 0.016 | 1 |
| | **TOC** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |

Notes:
1. “SU” is “Standard Units”
2. “mg/L” is “milligrams per Liter”
3. “ND” is “No Detect”
4. “St. Dev.” is “Standard Deviation”
5. “FC” is “Fecal Coliform”
6. “NTU” is “Nephelometric Turbidity Units

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

**Sample Location:** **SV-324**

| | | units | Avg. | SD | Median | Max | Min | N |
|---|---|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 6.20 | 0.48 | 6.17 | 7.08 | 5.36 | 11 |
| | **DO** | **mg/L** | 12.98 | 9.32 | 10.38 | 39.28 | 8.23 | 10 |
| | **Water Temperature** | **celsius** | 16.2 | 6.1 | 16.5 | 24.3 | 7.7 | 11 |
| | **Alkalinity** | **mg/L** | 8.8 | 7.3 | 6.2 | 30.0 | 4.0 | 11 |
| | **Turbidity** | **NTU** | 4.5 | 1.9 | 4.6 | 6.9 | 1.9 | 11 |
| | **BOD** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **TSS** | **mg/L** | 7.96 | 16.01 | 3.30 | 56.00 | 1.30 | 11 |
| | **Fecal Coliform (MFC)** | **FC/100mL** | 287 | 198 | 260 | 680 | 54 | 11 |
| | **NH3 NH4** | **mg/L** | 0.165 | 0.057 | 0.170 | 0.240 | 0.073 | 7 |
| | **NO3 NO2** | **mg/L** | 0.144 | 0.195 | 0.085 | 0.720 | 0.025 | 11 |
| | **TKN** | **mg/L** | 0.29 | 0.14 | 0.28 | 0.51 | 0.13 | 10 |
| | **Total Phosphorus** | **mg/L** | 0.045 | 0.015 | 0.048 | 0.073 | 0.026 | 11 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 2.13 | 0.90 | 2.60 | 2.70 | 1.10 | 3 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | 0.042 | 0.011 | 0.042 | 0.050 | 0.034 | 2 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **TOC** | **mg/L** | 3.2 | 1.4 | 2.5 | 4.9 | 2.3 | 3 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

Sample Location: SV-326

| | | units | Avg. | SD | Median | Max | Min | N |
|---|---|---|---|---|---|---|---|---|
| Monthly Parameters | pH | su | 6.54 | 0.55 | 6.69 | 7.12 | 5.32 | 11 |
| | DO | mg/L | 7.79 | 1.94 | 8.04 | 10.41 | 4.56 | 10 |
| | Water Temperature | celsius | 16.5 | 6.9 | 16.2 | 26.2 | 6.0 | 11 |
| | Alkalinity | mg/L | 19.6 | 10.9 | 21.0 | 45.0 | 3.5 | 11 |
| | Turbidity | NTU | 5.2 | 3.7 | 4.2 | 14.0 | 2.0 | 11 |
| | BOD | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | TSS | mg/L | 6.64 | 15.60 | 1.55 | 51.00 | 1.00 | 10 |
| | Fecal Coliform (MFC) | FC/100mL | 322 | 197 | 250 | 600 | 31 | 11 |
| | NH3 NH4 | mg/L | 0.182 | 0.085 | 0.190 | 0.290 | 0.066 | 8 |
| | NO3 NO2 | mg/L | 1.899 | 1.579 | 1.400 | 6.000 | 0.150 | 11 |
| | TKN | mg/L | 0.42 | 0.15 | 0.34 | 0.64 | 0.28 | 10 |
| | Total Phosphorus | mg/L | 0.214 | 0.162 | 0.175 | 0.670 | 0.028 | 12 |
| Quarterly Metals and TOC | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Iron | mg/L | 1.21 | 0.54 | 1.10 | 1.80 | 0.73 | 3 |
| | Mercury | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Manganese | mg/L | 0.080 | 0.022 | 0.087 | 0.098 | 0.056 | 3 |
| | Nickel | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Lead | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Zinc | mg/L | 0.022 | 0.007 | 0.025 | 0.026 | 0.014 | 3 |
| | TOC | mg/L | 4.9 | 1.0 | 4.9 | 5.8 | 3.9 | 3 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

| Sample Location: | SV-325 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | units | Avg. | SD | Median | Max | Min | N |
| Monthly Parameters | pH | su | 6.65 | 0.77 | 6.68 | 8.19 | 5.51 | 11 |
| | DO | mg/L | 9.18 | 0.89 | 9.06 | 10.54 | 8.10 | 10 |
| | Water Temperature | celsius | 16.5 | 5.3 | 16.7 | 23.4 | 8.9 | 11 |
| | Alkalinity | mg/L | 5.7 | 8.1 | 3.5 | 30.0 | 1.4 | 11 |
| | Turbidity | NTU | 4.4 | 3.3 | 3.1 | 13.0 | 1.9 | 11 |
| | BOD | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | TSS | mg/L | 6.15 | 9.05 | 3.80 | 33.00 | 1.00 | 11 |
| | Fecal Coliform (MFC) | FC/100mL | 292 | 218 | 250 | 600 | 40 | 11 |
| | NH3 NH4 | mg/L | 0.165 | 0.058 | 0.175 | 0.230 | 0.082 | 6 |
| | NO3 NO2 | mg/L | 0.347 | 0.715 | 0.130 | 2.500 | 0.075 | 11 |
| | TKN | mg/L | 0.31 | 0.12 | 0.27 | 0.48 | 0.17 | 8 |
| | Total Phosphorus | mg/L | 0.063 | 0.086 | 0.041 | 0.320 | 0.023 | 11 |
| Quarterly Metals and TOC | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Iron | mg/L | 0.49 | 0.16 | 0.42 | 0.68 | 0.38 | 3 |
| | Mercury | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Manganese | mg/L | 0.017333 | 0.005686 | 0.019 | 0.022 | 0.011 | 3 |
| | Nickel | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Lead | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Zinc | mg/L | 1.757 | 2.465 | 1.757 | 3.500 | 0.014 | 2 |
| | TOC | mg/L | 3.1 | 0.1 | 3.1 | 3.2 | 3.0 | 2 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

**Sample Location:** SV-2047

| | | units | Avg. | SD | Median | Max | Min | N |
|---|---|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 7.20 | 0.69 | 7.18 | 8.95 | 6.18 | 12.00 |
| | **DO** | **mg/L** | 9.72 | 1.48 | 9.69 | 12.48 | 7.41 | 12.00 |
| | **Water Temperature** | **celsius** | 106.2 | 309.6 | 17.4 | 1089.0 | 7.7 | 12.0 |
| | **Alkalinity** | **mg/L** | 18.2 | 4.1 | 18.0 | 24.0 | 11.0 | 12.0 |
| | **Turbidity** | **NTU** | 3.5 | 1.9 | 2.9 | 7.9 | 1.4 | 12.0 |
| | **BOD** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **TSS** | **mg/L** | 2.13 | 2.60 | 1.60 | 9.60 | 0.60 | 11.00 |
| | **Fecal Coliform (MFC)** | **FC/100mL** | 140 | 136 | 105 | 540 | 25 | 12 |
| | **NH3 NH4** | **mg/L** | 0.155 | 0.062 | 0.170 | 0.220 | 0.061 | 7.000 |
| | **NO3 NO2** | **mg/L** | 0.129 | 0.032 | 0.130 | 0.180 | 0.083 | 12.000 |
| | **TKN** | **mg/L** | 0.28 | 0.10 | 0.25 | 0.43 | 0.16 | 10.00 |
| | **Total Phosphorus** | **mg/L** | 0.032 | 0.013 | 0.027 | 0.058 | 0.020 | 10.000 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.69 | 0.36 | 0.58 | 1.10 | 0.40 | 3.00 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | 0.052 | 0.017 | 0.054 | 0.068 | 0.034 | 3.000 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **TOC** | **mg/L** | 5.0 | 0.8 | 5.2 | 5.7 | 4.2 | 3.0 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

**Sample Location:** **SV-327**

| | | units | Avg. | SD | Median | Max | Min | N |
|---|---|---|---|---|---|---|---|---|
| **Monthly Parameters** | **pH** | **su** | 6.98 | 0.28 | 6.98 | 7.50 | 6.55 | 12 |
| | **DO** | **mg/L** | 9.06 | 1.47 | 9.33 | 11.65 | 6.49 | 12 |
| | **Water Temperature** | **celsius** | 16.2 | 5.7 | 15.0 | 23.9 | 7.9 | 12 |
| | **Alkalinity** | **mg/L** | 22.1 | 4.8 | 23.5 | 28.0 | 13.0 | 12 |
| | **Turbidity** | **NTU** | 2.5 | 1.1 | 2.3 | 4.8 | 1.2 | 12 |
| | **BOD** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **TSS** | **mg/L** | 3.51 | 4.94 | 1.30 | 15.00 | 0.50 | 8 |
| | **Fecal Coliform (MFC)** | **FC/100mL** | 143 | 110 | 105 | 450 | 40 | 12 |
| | **NH3 NH4** | **mg/L** | 0.149 | 0.080 | 0.120 | 0.260 | 0.056 | 7 |
| | **NO3 NO2** | **mg/L** | 0.112 | 0.104 | 0.080 | 0.350 | 0.025 | 12 |
| | **TKN** | **mg/L** | 0.75 | 1.37 | 0.27 | 4.40 | 0.20 | 9 |
| | **Total Phosphorus** | **mg/L** | 0.072 | 0.097 | 0.038 | 0.270 | 0.021 | 6 |
| **Quarterly Metals and TOC** | **Cadmium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Chromium** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Copper** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Iron** | **mg/L** | 0.75 | 0.47 | 0.49 | 1.30 | 0.47 | 3 |
| | **Mercury** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Manganese** | **mg/L** | 0.103 | 0.094 | 0.060 | 0.210 | 0.038 | 3 |
| | **Nickel** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Lead** | **mg/L** | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | **Zinc** | **mg/L** | 0.034 | 0.000 | 0.034 | 0.034 | 0.034 | 1 |
| | **TOC** | **mg/L** | 3.8 | 1.1 | 4.4 | 4.5 | 2.6 | 3 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

| Sample Location: | SV-175 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | units | Avg. | SD | Median | Max | Min | N |
| Monthly Parameters | pH | su | 7.21 | 0.47 | 7.18 | 8.22 | 6.35 | 12 |
| | DO | mg/L | 8.64 | 1.97 | 9.15 | 12.92 | 5.97 | 12 |
| | Water Temperature | celsius | 16.5 | 5.9 | 15.3 | 24.4 | 8.0 | 12 |
| | Alkalinity | mg/L | 39.4 | 8.0 | 40.0 | 51.0 | 28.0 | 12 |
| | Turbidity | NTU | 2.9 | 2.1 | 2.1 | 8.5 | 1.1 | 12 |
| | BOD | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | TSS | mg/L | 2.61 | 2.91 | 1.70 | 9.60 | 0.50 | 9 |
| | Fecal Coliform (MFC) | FC/100mL | 263 | 302 | 175 | 1200 | 100 | 12 |
| | NH3 NH4 | mg/L | 0.170 | 0.060 | 0.185 | 0.250 | 0.081 | 8 |
| | NO3 NO2 | mg/L | 0.090 | 0.048 | 0.091 | 0.180 | 0.035 | 12 |
| | TKN | mg/L | 0.31 | 0.09 | 0.33 | 0.41 | 0.16 | 10 |
| | Total Phosphorus | mg/L | 0.038 | 0.013 | 0.037 | 0.055 | 0.020 | 11 |
| Quarterly Metals and TOC | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | 0.012 | 0.000 | 0.012 | 0.012 | 0.012 | 1 |
| | Iron | mg/L | 0.55 | 0.15 | 0.57 | 0.69 | 0.39 | 3 |
| | Mercury | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Manganese | mg/L | 0.063 | 0.022 | 0.073 | 0.079 | 0.038 | 3 |
| | Nickel | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Lead | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Zinc | mg/L | 0.013 | 0.000 | 0.013 | 0.013 | 0.013 | 1 |
| | TOC | mg/L | 4.8 | 1.3 | 4.8 | 6.1 | 3.6 | 3 |

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## Summary Statistics
## Nonradiological Monitoring of Surface Water

| Sample Location: | SV-328 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | units | Avg. | SD | Median | Max | Min | N |
| Monthly Parameters | pH | su | 7.14 | 0.29 | 7.23 | 7.53 | 6.54 | 12.00 |
| | DO | mg/L | 8.57 | 1.16 | 8.78 | 10.35 | 6.54 | 12.00 |
| | Water Temperature | celsius | 16.7 | 5.1 | 16.0 | 23.2 | 9.2 | 12.0 |
| | Alkalinity | mg/L | 40.5 | 8.0 | 41.0 | 52.0 | 28.0 | 12.0 |
| | Turbidity | NTU | 2.2 | 1.9 | 1.6 | 8.0 | 1.0 | 12.0 |
| | BOD | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | TSS | mg/L | 3.89 | 7.00 | 1.15 | 21.00 | 0.60 | 8.00 |
| | Fecal Coliform (MFC) | FC/100mL | 166 | 88 | 135 | 390 | 67 | 12 |
| | NH3 NH4 | mg/L | 0.213 | 0.078 | 0.230 | 0.300 | 0.086 | 5.000 |
| | NO3 NO2 | mg/L | 0.092 | 0.039 | 0.097 | 0.150 | 0.045 | 12.000 |
| | TKN | mg/L | 0.29 | 0.07 | 0.30 | 0.37 | 0.18 | 9.00 |
| | Total Phosphorus | mg/L | 0.035 | 0.016 | 0.028 | 0.069 | 0.021 | 10.000 |
| Quarterly Metals and TOC | Cadmium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Chromium | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Copper | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Iron | mg/L | 0.46 | 0.22 | 0.48 | 0.67 | 0.24 | 3.00 |
| | Mercury | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Manganese | mg/L | 0.059 | 0.033 | 0.042 | 0.097 | 0.037 | 3.000 |
| | Nickel | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Lead | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | Zinc | mg/L | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| | TOC | mg/L | 3.9 | 1.4 | 4.2 | 5.1 | 2.4 | 3.0 |

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## 2.5 Radiological and Nonradiological Monitoring of Sediments

### 2.5.1 Summary

The streams located on the Savannah River Site (SRS) receive treated wastewater and nonpoint source runoff from on-site facilities. Recent and historical data from SRS Environmental Reports indicate that the SRS waters were in accordance with Freshwaters Standard guidelines stated in the South Carolina Department of Health and Environmental Control (SCDHEC) Water Classifications and Standards Regulation 61-68 (SCDHEC 2006a).

The Environmental Surveillance Oversight Program (ESOP) as part of the South Carolina Department of Health and Environmental Control assessed the surface water quality on SRS by sampling the sediment in the on-site streams and the Savannah River for radiological, nonradiological, inorganic and organic contaminants. Samples are collected annually, on a three-year rotation, and on a five-year rotation; all samples are analyzed for specific parameters. Sample sites were strategically chosen to monitor ambient sediment conditions to detect any impact from Department of Energy–Savannah River (DOE-SR) operations beyond historically impacted areas.

ESOP collected sediment from 14 sample locations in 2006. All 14 locations were analyzed for gross alpha, gross non-volatile beta, gamma, and iodine-129. Due to a greater potential for public exposure, five of these 14 locations were analyzed for additional radiological parameters including plutonium-238, plutonium-239, total strontium, and technetium-99. Gross alpha was detected in four samples, non-volatile beta was detected in 13 samples, cesium-137 activity was detected in eight samples, and iodine-129 activity was detected in four samples. Plutonium-238 activity was detected in one sample, plutonium-239 was detected in one sample, and total strontium and technetium-99 were detected in all five samples.

Cesium-137 was the only consistently analyzed radiological parameter over the past several years. At a minimum, gross alpha, non-volatile beta and Cesium-137 will be analyzed for all samples for better trending of data.

Metals were released to surface streams from coal and ash and processing in M-Area, H-Area, and F-Ares. Metals were detected in many of the sediment samples.

Note that South Carolina state averages are from the Summary of Selected Water Quality Parameter Concentrations in South Carolina Water and Sediments.

ESOP will continue the independent monitoring and surveillance of SRS sediment to evaluate DOE-SR sediment data. The future locations, numbers of samples, sample frequencies and monitoring parameters may change to maximize available resources and address critical issues.

**RESULTS AND DISCUSSION**

**Radiological Parameter Results**

Gross alpha was detected in four of the 14 sediment samples collected. Alpha was detected at an

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average of 14.725 ± 5.876 picocuries per gram (pCi/g) and ranged from 6.3 to 18.9 pCi/g. Non-volatile beta was detected in 13 samples at an average of 17.543 ± 12.685 pCi/g and ranged from 4.01 to 49.3 pCi/g.

Cesium-137 is a fission product. Atmospheric cesium-137 was released from the separation areas. The liquid releases were from the reactors as a result of leaking fuel elements in the 1950s and 60s (WSRC 1998c). Cesium-137 activity was detected in eight samples at an average of 0.337 ± 0.194 pCi/g and ranged from 0.115 to 0.695 pCi/g.

Iodine was also produced by fission in the SRS reactors. Iodine was released into the atmosphere when the fuel and target elements were chemically dissolved in F-Area and H-Area (WSRC 1998c). Iodine-129 activity was detected in four samples at an average of 0.0179 ± 0.0177 pCi/g and ranged from 0.0018 to 0.0381 pCi/g.

Plutonium was formed at the SRS during the irradiation of nuclear fuel and targets during operation of the Site's five production reactors. Atmospheric releases of plutonium occurred mostly in F-Area and H-Area. There have been very few reports of plutonium releases to the streams of the SRS (WSRC 1998c). Plutonium-238 activity was detected in one of the five sediment samples collected with an activity level of 0.00291 pCi/g. Plutonium-239 was detected in one sample of the five collected at an activity level of 0.00259 pCi/g.

Strontium was produced at the SRS by fission in the reactors. Strontium was primarily released into the atmosphere from the separation process in F-Area and H-Area. Most of the stream releases came from the basin purges in the reactor areas (WSRC 1998c). Total Strontium was detected in all five of the samples at an average of 0.647 ± 0.257 pCi/g and ranged from 0.38 to 1.02 pCi/g.

SRS reports virtually no technetium releases although technetium-99 was detected in all five of the samples (WSCRC 1998c). It averaged 0.235 ± 0.112 pCi/g and ranged from 0.135 to 0.424 pCi/g. ESOP 2006 radiological statistical data can be found in section 2.5.4.

Cesium-137 was the only consistently analyzed parameter over the past several years. In the future alpha, non-volatile beta and cesium-137 will be analyzed for all samples for better trending of data. Trending data for cesium-137 in Savannah River sediment samples is in Figure 1, section 2.5.3. Cesium-137 levels have been consistently decreasing over the last five years.

**Nonradiological Parameter Results**

Metals were released to surface streams from coal and ash and processing in M-Area, H-Area, and F-Ares (RAC 1999). Metals were detected in many of the sediment samples.

Chromium solutions were used at the SRS as corrosive inhibitors. Chromium was a part of wastewater solutions resulting from dissolving stainless steel. It was also used in cleaning solutions in the separation areas (RAC 1999). Chromium was detected above the South Carolina state average of 13.39 mg/kg in four of the 14 sample locations. Detections averaged 9.89 ± 4.03

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mg/kg, which is within one standard deviation of the state average, and ranged from 4.6 to 15.00 mg/kg. For comparison, conservative EPA preliminary remediation goals, corresponding to a 1E-06 increased cancer risk, are 210 mg/kg for a residential scenario and 450 mg/kg for an industrial land use scenario (USEPA 2004b).

Copper was detected at one location at 40 mg/kg, which is above the state average of 9.13 mg/kg. For comparison, conservative EPA preliminary remediation goals, corresponding to a chronic risk for soil ingestion, are 3,100 mg/kg for a residential scenario and 41,000 mg/kg for an industrial land use scenario (USEPA 2004b).

Nickel was detected above the state average of 3.92 mg/kg at five of the sample locations. Detections averaged 4.80 ± 1.82 mg/kg, which is within one standard deviation of the state average, and ranged from 3.20to 9.3 mg/kg. For comparison, conservative EPA preliminary remediation goals, corresponding to a chronic risk for soil ingestion, are 1,600 mg/kg for a residential scenario and 20,000 mg/kg for an industrial land use scenario (USEPA 2004b).

Groundwater analysis suggests that lead has migrated from waste disposal sites (RAC 1999). Lead was detected at one location at 18 mg/kg, which is above the state average of 16.32 mg/kg. For comparison, conservative EPA preliminary remediation goals, corresponding to a chronic risk, are 6100 mg/kg for a residential scenario and 620 mg/kg for an industrial land use scenario (USEPA 2004b).

Zinc has been released from the coal and ash piles and basins (RAC 1995). Zinc was detected above the state average of 21.61 mg/kg at five of the 14 sample locations. Detections averaged 19.52 ± 16.08 mg/kg, which is within one standard deviation of the state average, and ranged from 1.10 to 60.0 mg/kg. For comparison, conservative EPA preliminary remediation goals, corresponding to a chronic risk for soil ingestion, are 23,000 mg/kg for a residential scenario and 310,000 mg/kg for an industrial land use scenario (USEPA 2004b).

There were some sporadic pesticide and herbicide detections at very low levels.

Total Kjeldahl Nitrogen (TKN) has been consistently detected above the state average, over the last seven years, at the Lower Three Runs sample site SV-175. TKN peaked from 2000 to 2002, and then descended to below the state average in 2005. This is shown in Figure 2, section 2.5.3. Detected TKN is likely due to agricultural runoff. Sample location SV-175 was not tested in 2006.

Over the past eight years there have been sporadic detections of metals and nutrients above the South Carolina state averages in the SRS streams. These detections have not been consistently seen in every year. ESOP 2006 nonradiological statistical data can be found in section 2.5.5.

Note that South Carolina state averages are from the Summary of Selected Water Quality Parameter Concentrations in South Carolina Water and Sediments (SCDHEC, 1998). ESOP nonradiological sediment data can be found in section 2.5.4.

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**DOE-SR Data Comparison**

DOE-SR samples many locations in addition to the ESOP sampling routine. DOE-SR and ESOP split samples in November 2006. Samples collected from both sampling events exhibited variability between ESOP and DOE-SR analytical results. Discrepancies among data results may be attributed to differences in laboratory collection date, methodology, field procedures, and/or sample location and size.

Cesium-137 was the only manmade gamma-emitting radionuclide tested by both DOE-SR and ESOP. The highest cesium-137 concentration was detected by DOE-SR at a location not sampled by ESOP. DOE-SR detected 497 ± 10.51 pCi/g of cesium-137 at R-Canal. When DOE-SR and ESOP split samples in November 2006, the highest detected cesium-137 concentration detected by both agencies was at Savannah River mile 129. DOE-SR detected 0.486 ± 0.055 pCi/g while ESOP detected 0.261 ± 0.051 pCi/g. Within the split samples the analytical results varied by five standard deviations due to the highly variable nature of metals in sediment (Alloway 1995).

A nonradiological comparison of DOE-SR and ESOP sediment data could not be conducted because of different methods used for analyzing sediments.

## CONCLUSIONS AND RECOMMENDATIONS

ESOP will continue independent monitoring of SRS sediments and will periodically evaluate modification of the monitoring activities to better accomplish project goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide and non-radionuclide activity in SRS sediments and the Savannah River. It will impart valuable information to human health exposure pathways. The comparison of data results allows for independent data verification of DOE-SR monitoring activities. Cooperation between DOE-SR and ESOP provides credibility and confidence in the information being provided to the public.

In 2007, ESOP will be collecting random sediment samples from all over South Carolina. These samples will be analyzed for radiological contaminants and compared to the normally sampled locations from the SRS. This will give a better view as to the impacts of the SRS on the streams and sediments of South Carolina.

ESOP will also be collecting samples with DOE-SR at six storm water basins in 2007 and monitored for potential radiological contamination.

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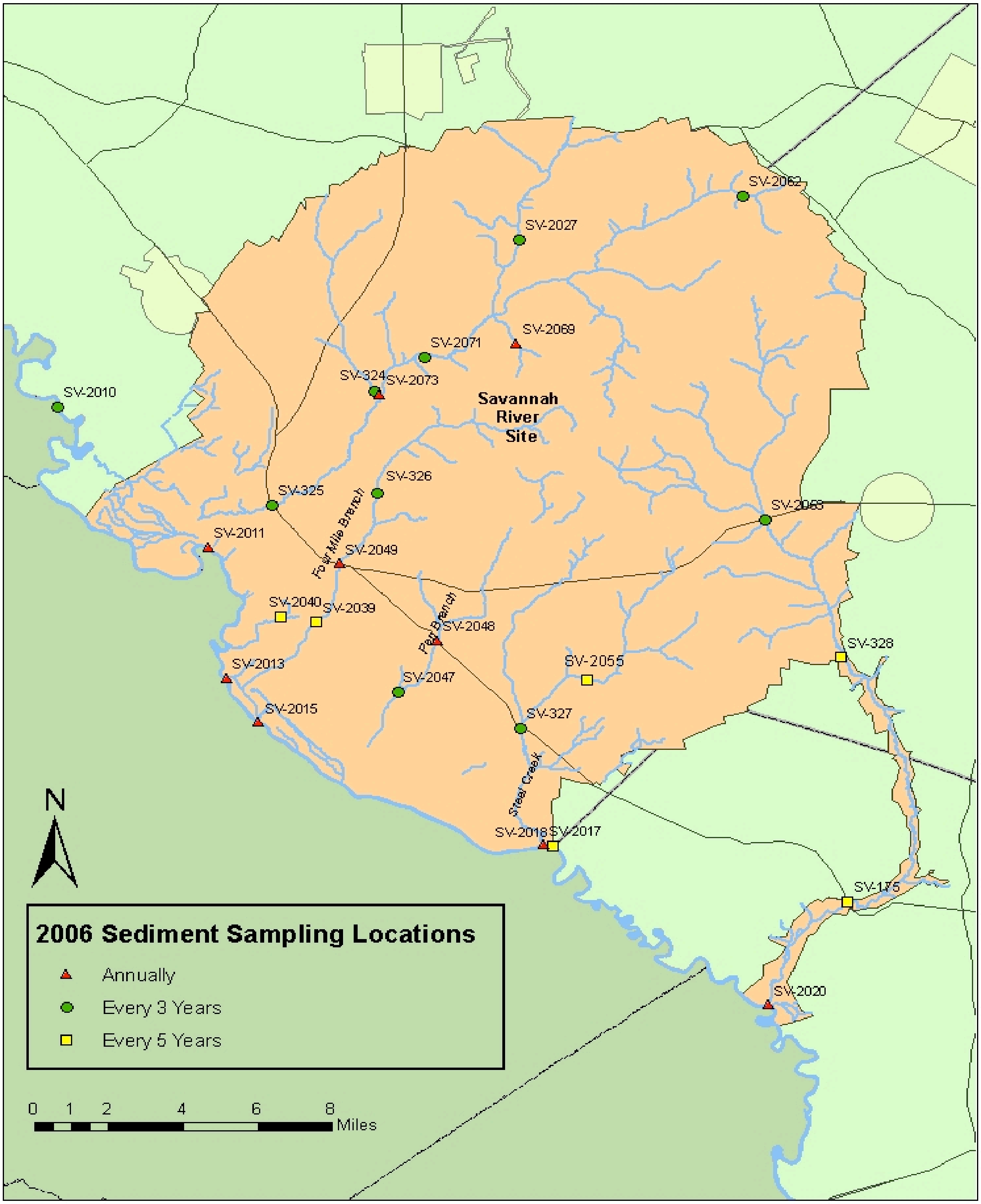
## 2.5.2
## Map 7. Radiological and Nonradiological Monitoring of Sediment

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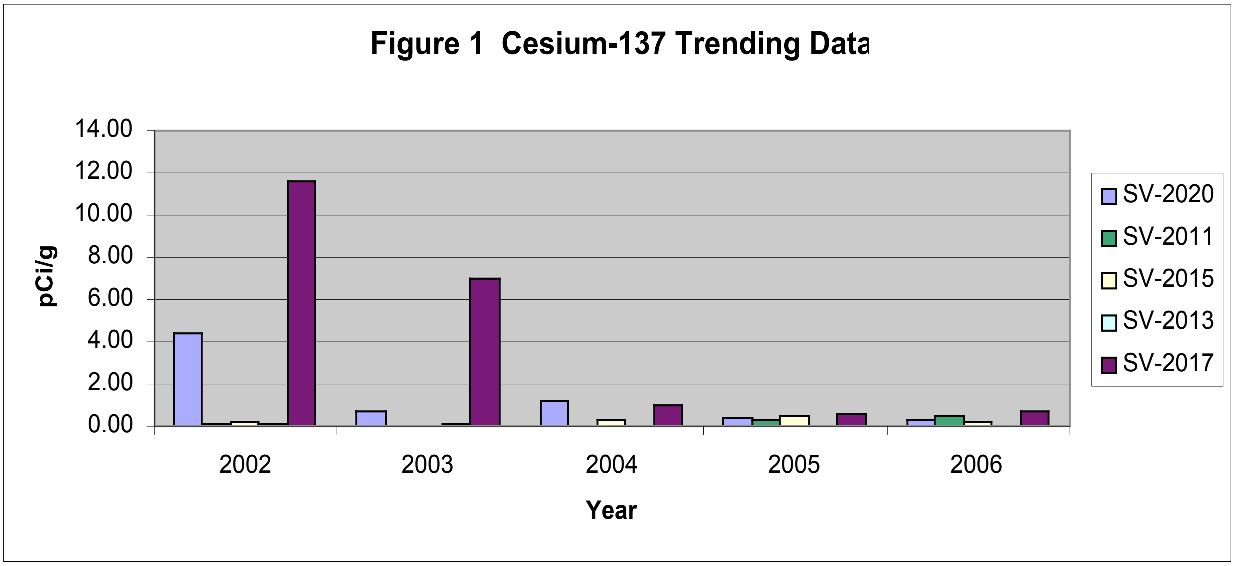
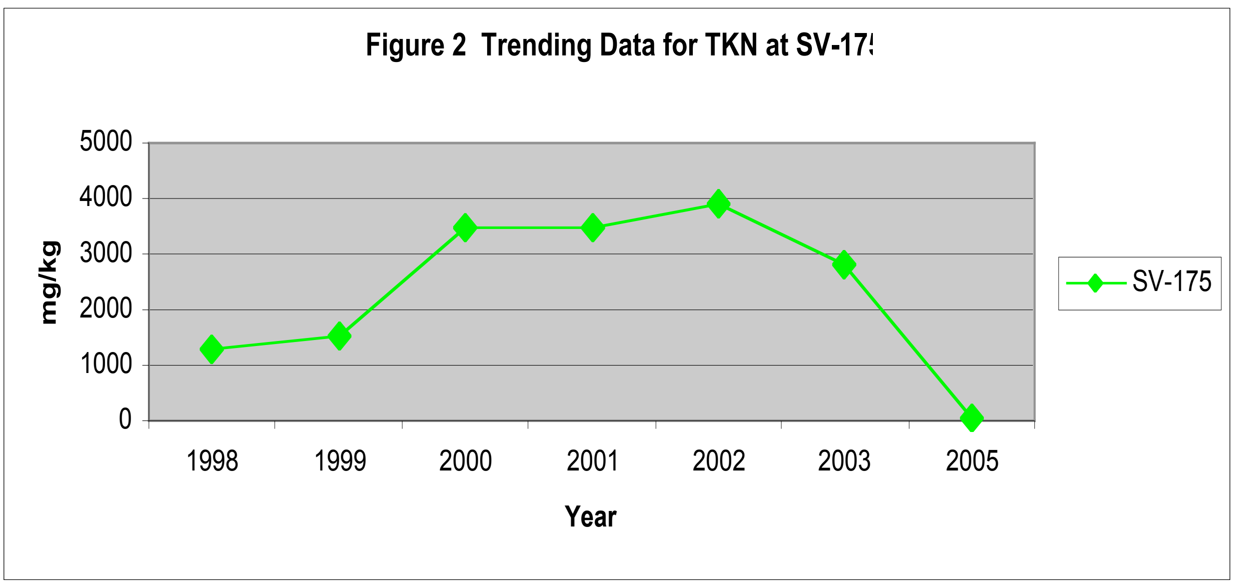
### 2.5.3 Tables and Figures
### Radiological and Nonradiological Monitoring of Sediments

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## 2.5.4 Data
## Radiological and Nonradiological Monitoring of Sediments



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## Radiological and Nonradiological Monitoring of Sediments
## Radiological Data

| System Number: | | | SMSV-2049 | SMSV-2040 | SMSV-2048 | SMSV-2018 |
|---|---|---|---|---|---|---|
| Date: | | | 11/13/06 | 11/13/06 | 11/13/06 | 11/13/06 |
| Radionuclides | Gross Alpha | (pCi/g) | <21.3 | <26.9 | <34.0 | <23.6 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/g) | 4.01 | <4.08 | 49.3 | 31 |
| | ±2 | (sigma) | 2.34 | | 8.06 | 4.24 |
| | Cesium-137 | (pCi/g) | 0.4377 | <0.01979 | <0.08485 | 0.3461 |
| | ±2 | (sigma) | 0.05611 | | | 0.06035 |
| | Iodine-129 | (pCi/g) | 0.0381 | <0.0636 | <0.0408 | <0.0212 |
| | ±2 | (sigma) | 0.0109 | | | |
| | Plutonium-238 | (pCi/g) | NS | <3.08E-09 | NS | <4.09E-09 |
| | ±2 | (sigma) | | | | |
| | Plutonium-239 | (pCi/g) | NS | <0.0118 | NS | <0.00367 |
| | ±2 | (sigma) | | | | |
| | Total Strontium | (pCi/g) | NS | 0.634 | NS | 0.38 |
| | ±2 | (sigma) | | 0.363 | | 0.265 |
| | Technetium-99 | (pCi/g) | NS | 0.135 | NS | 0.424 |
| | ±2 | (sigma) | | 0.185 | | 0.234 |

| System Number: | | | SMSV-2062 | SMSV-2069 | SMSV-2071 | SMSV-2010 |
|---|---|---|---|---|---|---|
| Date: | | | 11/14/06 | 11/14/06 | 11/14/06 | 11/14/06 |
| Radionuclides | Gross Alpha | (pCi/g) | <22.4 | <29.0 | <26.2 | <22.1 |
| | ±2 | (sigma) | | | | |
| | N-V Beta | (pCi/g) | 7.27 | 18.5 | 7.71 | 16.5 |
| | ±2 | (sigma) | 2.63 | 6.66 | 2.89 | 3.62 |
| | Cesium-137 | (pCi/g) | <0.02549 | 0.1799 | <0.02649 | <0.03270 |
| | ±2 | (sigma) | | 0.05577 | | |
| | Iodine-129 | (pCi/g) | <0.0679 | <0.0625 | 0.0045 | <0.00884 |
| | ±2 | (sigma) | | | | |
| | Plutonium-238 | (pCi/g) | <0.0059 | NS | <0.00651 | 0.00291 |
| | ±2 | (sigma) | | | | 0.0087 |
| | Plutonium-239 | (pCi/g) | 0.00259 | NS | <0.00975 | <0.00774 |
| | ±2 | (sigma) | | | | |
| | Total Strontium | (pCi/g) | 0.758 | NS | 1.02 | 0.444 |
| | ±2 | (sigma) | 0.37 | | 0.38 | 0.188 |
| | Technetium-99 | (pCi/g) | 0.171 | NS | 0.211 | 0.233 |
| | ±2 | (sigma) | 0.176 | | 0.176 | 0.182 |

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## Radiological and Nonradiological Monitoring of Sediments
## Radiological Data

| System Number: | | | SMSV-2073 | SMSV-2011 | SMSV-2013 |
|---|---|---|---|---|---|
| Date: | | | 11/14/06 | 11/20/06 | 11/20/06 |
| Radionuclides | Gross Alpha | (pCi/g) | <24.2 | <12.5 | 18.6 |
| | ±2 | (sigma) | | | 12.1 |
| | N-V Beta | (pCi/g) | 23.2 | 28.1 | 11.96 |
| | ±2 | (sigma) | 4.76 | 7.62 | 4.61 |
| | Cesium-137 | (pCi/g) | 0.1154 | 0.4812 | <0.03992 |
| | ±2 | (sigma) | 0.05098 | 0.07896 | |
| | Iodine-129 | (pCi/g) | <0.0466 | 0.00175 | <0.0436 |
| | ±2 | (sigma) | | 0.012 | |
| | Plutonium-238 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Plutonium-239 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Total Strontium | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Technetium-99 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |

| System Number: | | | SMSV-2015 | SMSV-2017 | SMSV-2020 |
|---|---|---|---|---|---|
| Date: | | | 11/20/06 | 11/20/06 | 11/20/06 |
| Radionuclides | Gross Alpha | (pCi/g) | 15.1 | 6.3 | 18.9 |
| | ±2 | (sigma) | 9.2 | 5.5 | 16.5 |
| | N-V Beta | (pCi/g) | 11.71 | 6.87 | 11.93 |
| | ±2 | (sigma) | 4.23 | 3.62 | 4.82 |
| | Cesium-137 | (pCi/g) | 0.1782 | 0.695 | 0.2606 |
| | ±2 | (sigma) | 0.03433 | 0.07149 | 0.05126 |
| | Iodine-129 | (pCi/g) | 0.0274 | <0.0106 | <0.0264 |
| | ±2 | (sigma) | 0.086 | | |
| | Plutonium-238 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Plutonium-239 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Total Strontium | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |
| | Technetium-99 | (pCi/g) | NS | NS | NS |
| | ±2 | (sigma) | | | |

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## Radiological and Nonradiological Monitoring of Sediments
## Nonradiological Data

| Sample Location: | | | SMSV-2049 | SMSV-2040 | SMSV-2048 | SMSV-2018 |
|---|---|---|---|---|---|---|
| Sample Date: | | | 11/13/2006 | 11/13/2006 | 11/13/2006 | 11/13/2006 |
| Metals | Cadmium | mg/kg | <1.0 | <1.0 | <1.0 | <1.0 |
| | Chromium | mg/kg | 5.1 | <1.0 | 15 | 14 |
| | Copper | mg/kg | <1.0 | <1.0 | 5 | 4.8 |
| | Iron | mg/kg | 1300 | 940 | 10000 | 8600 |
| | Mercury | mg/kg | <0.10 | <0.10 | <1.0 | <1.0 |
| | Manganese | mg/kg | 160 | 13 | 570 | 600 |
| | Nickel | mg/kg | <2.0 | <2.0 | 3.9 | 3.9 |
| | Lead | mg/kg | <5.0 | <5.0 | 13 | 18 |
| | Zinc | mg/kg | 5.6 | 2.3 | 30 | 30 |
| Pesticides and Herbicides | p,p'-DDE | mg/kg | <0.0020 | <0.0020 | 0.0042 | 0.0042 |
| | Benzoic Acid | mg/kg | <0.30 | <0.30 | 0.79 | 0.79 |
| | Bis(2-ethylexyl)phylate | mg/kg | <0.30 | <0.30 | <0.30 | <0.30 |
| | Benzo(ghi)perylene | mg/kg | <0.30 | <0.30 | 0.48 | 0.48 |
| | Dibenzo(a,h)anthracene | mg/kg | <0.30 | <0.30 | 0.39 | 0.39 |
| | Di-n-octylphthalate | mg/kg | <0.30 | <0.30 | 0.64 | 0.64 |
| | Indeno(1,2,3-cd)pyrene | mg/kg | <0.30 | <0.30 | 0.4 | 0.4 |

| Sample Location: | | | SMSV-2062 | SMSV-2069 | SMSV-2071 | SMSV-2010 |
|---|---|---|---|---|---|---|
| Sample Date: | | | 11/14/2006 | 11/14/2006 | 11/14/2006 | 11/14/2006 |
| Metals | Cadmium | mg/kg | <1.0 | <1.0 | <1.0 | <1.0 |
| | Chromium | mg/kg | <1.0 | 14 | <1.0 | 4.6 |
| | Copper | mg/kg | <1.0 | 40 | <1.0 | 2.7 |
| | Iron | mg/kg | 310 | 6500 | 380 | 4300 |
| | Mercury | mg/kg | <0.10 | <1.0 | <0.10 | <0.10 |
| | Manganese | mg/kg | 11 | 160 | 3.9 | 260 |
| | Nickel | mg/kg | <2.0 | 9.3 | <2.0 | <2.0 |
| | Lead | mg/kg | <5.0 | 16 | <5.0 | 6.2 |
| | Zinc | mg/kg | 1.1 | 60 | 1.4 | 14 |
| Pesticides and Herbicides | p,p'-DDE | mg/kg | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | Benzoic Acid | mg/kg | <0.30 | 0.64 | <0.30 | <0.30 |
| | Bis(2-ethylexyl)phylate | mg/kg | <0.30 | <0.30 | <0.30 | 0.58 |
| | Benzo(ghi)perylene | mg/kg | <0.30 | <0.30 | <0.30 | <0.30 |
| | Dibenzo(a,h)anthracene | mg/kg | <0.30 | <0.30 | <0.30 | <0.30 |
| | Di-n-octylphthalate | mg/kg | <0.30 | <0.30 | <0.30 | <0.30 |
| | Indeno(1,2,3-cd)pyrene | mg/kg | <0.30 | <0.30 | <0.30 | <0.30 |

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## Radiological and Nonradiological Monitoring of Sediments
## Nonradiological Data

| Sample Location: | | | SMSV-2073 | SMSV-2011 | SMSV-2013 |
|---|---|---|---|---|---|
| Sample Date: | | | 11/14/2006 | 11/20/2006 | 11/20/2006 |
| Metals | Cadmium | mg/kg | <1.0 | <1.0 | <1.0 |
| | Chromium | mg/kg | 8.4 | 14 | 5.9 |
| | Copper | mg/kg | 6.7 | 7.7 | 4.4 |
| | Iron | mg/kg | 2800 | 11000 | 5600 |
| | Mercury | mg/kg | <0.10 | <0.10 | <0.10 |
| | Manganese | mg/kg | 21 | 600 | 320 |
| | Nickel | mg/kg | 4.5 | 5.1 | 4.6 |
| | Lead | mg/kg | 10 | 16 | 6.7 |
| | Zinc | mg/kg | 18 | 34 | 16 |
| Pesticides and Herbicides | p,p'-DDE | mg/kg | <0.0020 | 0.0042 | 0.0042 |
| | Benzoic Acid | mg/kg | <0.30 | 0.79 | 0.79 |
| | Bis(2-ethylexyl)phylate | mg/kg | <0.30 | <0.30 | <0.30 |
| | Benzo(ghi)perylene | mg/kg | <0.30 | 0.48 | 0.48 |
| | Dibenzo(a,h)anthracene | mg/kg | <0.30 | 0.39 | 0.39 |
| | Di-n-octylphthalate | mg/kg | <0.30 | 0.64 | 0.64 |
| | Indeno(1,2,3-cd)pyrene | mg/kg | <0.30 | 0.4 | 0.4 |

| Sample Location: | | | SMSV-2015 | SMSV-2017 | SMSV-2020 |
|---|---|---|---|---|---|
| Sample Date: | | | 11/20/2006 | 11/20/2006 | 11/20/2006 |
| Metals | Cadmium | mg/kg | <1.0 | <1.0 | <1.0 |
| | Chromium | mg/kg | 6.5 | 9.3 | 12 |
| | Copper | mg/kg | 2.8 | 5.2 | 5.7 |
| | Iron | mg/kg | 5400 | 12000 | 9100 |
| | Mercury | mg/kg | <0.10 | <0.10 | <0.10 |
| | Manganese | mg/kg | 610 | 510 | 660 |
| | Nickel | mg/kg | 3.2 | 3.5 | 5.2 |
| | Lead | mg/kg | 6.7 | 14 | 12 |
| | Zinc | mg/kg | 16 | 17 | 28 |
| Pesticides and Herbicides | p,p'-DDE | mg/kg | 0.0042 | 0.0042 | 0.0042 |
| | Benzoic Acid | mg/kg | 0.79 | 0.79 | 0.79 |
| | Bis(2-ethylexyl)phylate | mg/kg | <0.30 | <0.30 | <0.30 |
| | Benzo(ghi)perylene | mg/kg | 0.48 | 0.48 | 0.48 |
| | Dibenzo(a,h)anthracene | mg/kg | 0.39 | 0.39 | 0.39 |
| | Di-n-octylphthalate | mg/kg | 0.64 | 0.64 | 0.64 |
| | Indeno(1,2,3-cd)pyrene | mg/kg | 0.4 | 0.4 | 0.4 |

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## 2.5.5 Summary Statistics
## Radiological and Nonradiological Monitoring of Sediments

### Radiological

| Date: | Nov-06 | | median | average | SD | Max | Min | Number |
|---|---|---|---|---|---|---|---|---|
| Radionuclides | Gross Alpha | (pCi/g) | 16.85 | 14.73 | 5.88 | 18.90 | 6.30 | 4 |
| | N-V Beta | (pCi/g) | 11.96 | 17.54 | 12.69 | 49.30 | 4.01 | 13 |
| | Cesium-137 | (pCi/g) | 0.303 | 0.337 | 0.194 | 0.695 | 0.115 | 8 |
| | Iodine-129 | (pCi/g) | 0.016 | 0.018 | 0.018 | 0.038 | 0.002 | 4 |
| | Plutonium-238 | (pCi/g) | 0.003 | 0.003 | 0.000 | 0.003 | 0.003 | 1 |
| | Plutonium-239 | (pCi/g) | 0.003 | 0.003 | 0.000 | 0.003 | 0.003 | 1 |
| | Total Strontium | (pCi/g) | 0.634 | 0.647 | 0.257 | 1.020 | 0.380 | 5 |
| | Technetium-99 | (pCi/g) | 0.211 | 0.235 | 0.112 | 0.424 | 0.135 | 5 |

### Nonradiological

| Date: | Nov-06 | | Median | Avg | St Dev | Max | Min | Number |
|---|---|---|---|---|---|---|---|---|
| Metals | Chromium | mg/kg | 9.30 | 9.89 | 4.03 | 4.60 | 15.00 | 11 |
| | Copper | mg/kg | 5.10 | 8.50 | 11.17 | 2.70 | 40.00 | 10 |
| | Iron | mg/kg | 5500 | 5588 | 4081 | 310 | 12000 | 14 |
| | Manganese | mg/kg | 290.00 | 321.35 | 261.49 | 3.90 | 660.00 | 14 |
| | Nickel | mg/kg | 4.50 | 4.80 | 1.82 | 3.20 | 9.30 | 9 |
| | Lead | mg/kg | 12.50 | 11.86 | 4.30 | 6.20 | 18.00 | 10 |
| | Zinc | mg/kg | 16.50 | 19.53 | 16.08 | 1.10 | 60.00 | 14 |
| Pesticides and Herbicides | p,p'-DDE | mg/kg | 0.004 | 0.004 | 0 | 0.004 | 0.004 | 7 |
| | Benzoic Acid | mg/kg | 0.790 | 0.771 | 0.053 | 0.640 | 0.790 | 8 |
| | Bis(2-ethylexyl)phylate | mg/kg | 0.580 | 0.580 | 0 | 0.580 | 0.580 | 1 |
| | Benzo(ghi)perylene | mg/kg | 0.480 | 0.480 | 0 | 0.480 | 0.480 | 7 |
| | Dibenzo(a,h)anthracene | mg/kg | 0.390 | 0.390 | 0 | 0.390 | 0.390 | 7 |
| | Di-n-octylphthalate | mg/kg | 0.640 | 0.640 | 0 | 0.640 | 0.640 | 7 |
| | Indeno(1,2,3-cd)pyrene | mg/kg | 0.400 | 0.400 | 0 | 0.400 | 0.400 | 7 |

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## 3.1 Surface Soil Monitoring

### 3.1.1 Summary

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) provides independent evaluation of Department of Energy – Savannah River (DOE-SR) environmental monitoring programs. ESOP personnel independently evaluated surface soils for select gamma-emitting radionuclides, an Environmental Protection Agency (EPA) specified Target Analyte List (TAL) for metals, and specific radionuclides. These soil samples were collected to determine if Savannah River Site (SRS) activities might have impacted areas outside of the site boundaries. The primary potential pathway for contaminants to migrate off of SRS is through air. This may come as a result of the resuspension and subsequent airborne contamination of materials due to cleanup processes and prescribed burns.

The ESOP surface soil monitoring project changed in 2004 to include more random coverage of perimeter soils (those within 50 miles of SRS) and background soils (those greater than 50 miles). This sampling program was implemented to allow future probabilistic comparisons of the SRS perimeter and South Carolina (SC) background contaminant levels in soils. ESOP collected samples in 2006 from 12 perimeter sites within the 50-mile radius of SRS and 12 background sites outside of the 50-mile radius. In addition to this random sampling regime, 12 non-random samples were collected from both perimeter and background locations. There were a total of 24 perimeter and 24 background soil samples collected in 2006. Random sampling locations are located on Map 1, page xiii, and nonrandom sampling locations are located on Map 8, section 3.1.2.

ESOP initiated the random sampling system to determine if elevated levels of contaminants were attributed to SRS activities. Averages for random background (B) samples were subtracted from random perimeter (E) samples to determine SRS off-site 50-mile perimeter environmental concentrations above SC background. These perimeter minus background (E-B) averages were used to determine if data collected by ESOP were comparable to DOE-SR data.

Cesium 137 (Cs-137) was the only radionuclide where ESOP and DOE-SR shared analysis results. Due to low sample power, probablistic testing of the ESOP 2006 SRS perimeter and SC background data has conflicting results for rejecting the null hypothesis that SRS perimeter samples and SC background samples are the same. However, the null hypothesis is not rejected by any test for the ESOP 2004-2006 random data. DOE-SR does not collect samples for metals, gross alpha, and gross beta so no comparison between DOE-SR and ESOP data was made. All E-B averages for metals in ESOP samples were below the EPA's Region 9 Preliminary Remediation Goals for soils.

**RESULTS AND DISCUSSION**

Gamma

Potassium-40 (K-40), Zinc-65 (Z-65), Cesium-137 (Cs-137), Europium-155 (Eu-155), Lead-212

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and -214 (Pb-212, Pb-214), Radium-226 (Ra-226), and Actinium-228 (Ac-228) were the only gamma-emitting radionuclides detected among perimeter and background samples.

These are Naturally Occurring Radioactive Material (NORM) decay products, which may account for these detections. All other gamma-emitting radionuclides had no detections above their respective Minimum Detectable Activity (MDA). Gamma data for radionuclides, where at least one detect was recorded for either the random perimeter or random background locations, is given in Table 1, section 3.1.3. This data represents all random data collected from every sampling location and can be considered to be a grand average for each radionuclide. All gamma data is given in section 3.1.4.

Gross Alpha

Analyses were conducted on alpha-emitting radionuclides in samples collected during each quarter of 2006. The highest detected alpha activity (20.30 pCi/g with an uncertainty of 9.97 pCi/g) was in a non-random background sample collected from Jasper County. The gross alpha data, where at least one detect was recorded for either the random perimeter or random background locations, is given in Table 2, section 3.1.3. All alpha data is given in section 3.1.4.

Gross Beta

Analyses were conducted on beta-emitting radionuclides in samples collected during each quarter of 2006. The highest detected beta activity (33.00 pCi/g with an uncertainty of 3.84 pCi/g) was in a nonrandom background sample collected from Lexington County. The gross beta data, where at least one detect was recorded for either the random perimeter or random background locations, is given in Table 2, section 3.1.3. All beta data is given in section 3.1.4.

Nonradiological

Sixteen of the 24 metals from the TAL had a detect either in a perimeter or background sample. Data for metal concentrations in all ESOP samples, where at least one detect was recorded, is given in Table 3, section 3.1.3. All metals data is given in section 3.1.4.

Statistical Summary

Background (B) sample averages were subtracted from perimeter (E) sample averages to determine the SRS random environmental concentrations above background (Tables 1-3, section 3.1.3). If this number was greater than zero and the radionuclide was associated with SRS, then further statistical analysis was conducted. Statistical analysis of data between ESOP and DOE-SR cannot be done since DOE-SR does not do random sampling. However, since ESOP collects random samples, a statistical comparison can be done between SRS perimeter and SC background samples. This comparison can be used to determine the statistical significance of any differences encountered between perimeter and background samples collected by ESOP. ESOP data can be compared to DOE-SR data using standard deviation.

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When the random perimeter and random background samples were averaged, only five radionuclides had an “E-B” average greater than zero (Cs-137, Pb-212, Pb-214, Ra-226, and Ac-228). These averages were calculated to provide a more accurate characterization of the contaminant concentrations throughout the sampling area. DOE-SR did not conduct analysis of Pb-212, Pb-214, Ra-226, and Ac-228. These are NORM and any detected levels may result from the decay of natural products. Cesium-137 is a fission product and any elevated levels could be related to anthropogenic activity. Statistical analyses of Cs-137 were done using ESOP random sampling averages. The null hypothesis that the SRS perimeter random soil and the SC background random soil Cs-137 populations are the same was disproven by the application of the Wilcoxon Rank Sum but was not disproven by the modified Quantile tests at the 0.05 significance level (Michigan 2002; U.S. EPA, 2000c). Sampling power was not sufficient to support the alternative hypothesis that the two populations were different. Additionally, the null hypothesis on the 2004-2006 data was not rejected by several statistical tests at the 0.01 significance level. Since a statistical significance was established between the 2006 ESOP SRS perimeter and SC background sample data, then the “E-B” ESOP average could be compared to DOE-SR data. The ESOP random “E-B” average for Cs-137 was 0.105 pCi/g. The DOE-SR Cs-137 average was 0.391 pCi/g with an uncertainty of 0.211 pCi/g (WSRC 2006). The ESOP average for Cs-137 falls within one standard deviation (SD) of the DOE-SR data. Therefore, the data reported by DOE-SR is comparable to the data reported by ESOP.

DOE-SR did not collect samples for metals analysis, so no comparison to ESOP metals data can be made. The ESOP data was used to calculate “E-B” averages from the “detects only” data for metals. Twelve metals had “E-B” averages greater than zero (Al, Ba, Be, Co, Cr, Cu, Fe, Ni, Pb, Ti, V, Zi). All of these averages were below the Region 9 Preliminary Remediation Goals (PRGs) for residential soil established by the EPA (USEPA 2002b).

## CONCLUSIONS AND RECOMMENDATIONS

ESOP incorporated a random sampling regime to conduct statistical tests to determine if differences in concentrations between perimeter samples and background samples were significant. The primary objective was to determine if the SRS 50-mile perimeter samples were greater than the SC background.

The hypothesis that the 50-mile SRS perimeter random soil population for Cs-137 was the same as the South Carolina background random Cs-137 population was not disproven by statistical analysis. The ESOP “E-B detects only” average was within one SD of the DOE-SR data. Cesium-137 within the 50-mile SRS perimeter is not significantly different than the SC background at the 0.05 level. Based on this data, there is statistical evidence that SRS operations are not impacting areas outside of the 50 mile SRS perimeter in South Carolina. Furthermore, SRS should not have any direct impact on soil collected from locations that are in far proximity of SRS. Any detections in these particular samples may be related to other nuclear facilities, NORM, or past nuclear testing. Additionally, differences in metal concentrations may be attributed to soil composition. Random sample collection from a variety of background locations may provide a better characterization of the soil types throughout the state.

**Back**

ESOP will continue to conduct random sampling in addition to nonrandom sampling. The random sampling will allow more probabilistic tests on SRS perimeter and SC background samples. The possibility of comparing elevated maximums across South Carolina with nuclear fallout radioactive deposition tracks may be achieved at some time in the future.

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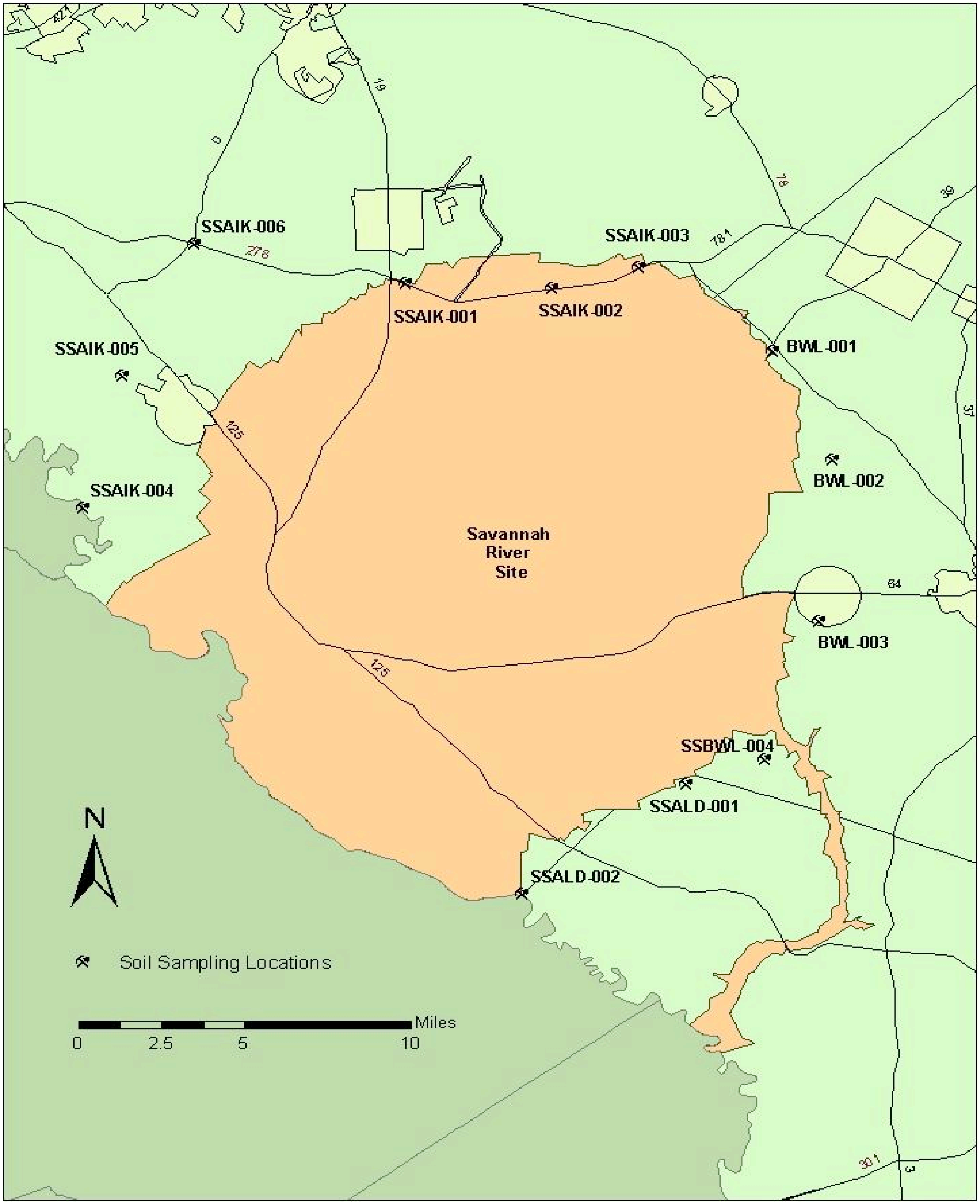
## 3.1.2
## Map 8. Radiological Monitoring of Soil Locations

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### 3.1.3 Tables and Figures
### Surface Soil Monitoring

Table 1. Random SRS perimeter minus SC background averages for gamma.

| | | Perimeter Samples (<50 miles) | | | Background Samples(>50 miles) | | | E-B | E-B |
|---|---|---|---|---|---|---|---|---|---|
| | | **AVERAGE** | **ST. DEV** | **MEDIAN** | **AVERAGE** | **ST. DEV** | **MEDIAN** | **AVERAGE** | **MEDIAN** |
| K-40 | D Only | 5.434 | 4.315 | 3.799 | 7.368 | 5.055 | 6.181 | -1.934 | -2.383 |
| | D + 0.5 MDA ND | 3.670 | 4.317 | 1.819 | 4.971 | 5.366 | 4.235 | -1.301 | -2.416 |
| Cs-137 | D Only | 0.331 | 0.303 | 0.153 | 0.217 | 0.148 | 0.138 | 0.114 | 0.016 |
| | D + 0.5 MDA ND | 0.305 | 0.303 | 0.146 | 0.134 | 0.150 | 0.095 | 0.159 | 0.051 |
| Eu-155 | D Only | NA | NA | NA | 0.124 | NA | 0.124 | NA | NA |
| | D + 0.5 MDA ND | NA | NA | NA | 0.051 | 0.026 | 0.048 | NA | NA |
| Pb-212 | D Only | 1.593 | 0.597 | 1.431 | 0.378 | 0.271 | 0.329 | 1.215 | 1.102 |
| | D + 0.5 MDA ND | 0.543 | 0.835 | 0.025 | 0.167 | 0.248 | 0.023 | 0.376 | 0.002 |
| Pb-214 | D Only | 1.415 | 1.457 | 0.979 | 0.549 | 0.230 | 0.584 | 0.866 | 0.395 |
| | D + 0.5 MDA ND | 1.415 | 1.457 | 0.979 | 0.549 | 0.230 | 0.584 | 0.866 | 0.395 |
| Ra-226 | D Only | 3.747 | 3.672 | 2.726 | 2.013 | 0.637 | 1.699 | 1.734 | 1.027 |
| | D + 0.5 MDA ND | 3.159 | 3.594 | 2.522 | 1.278 | 1.024 | 1.521 | 1.881 | 1.001 |
| Ac-228 | D Only | 1.239 | 0.507 | 1.224 | 0.869 | 0.120 | 0.928 | 0.370 | 0.296 |
| | D + 0.5 MDA ND | 1.239 | 0.507 | 1.224 | 0.422 | 0.402 | 0.138 | 0.818 | 1.086 |

Table 2. Random SRS perimeter minus SC background averages for alpha/beta.

| | Perimeter Samples (<50 Miles) | | | Background Samples (>50 Samples) | | | E-B | E-B |
|---|---|---|---|---|---|---|---|---|
| Alpha | **Average** | **St. Deviation** | **Median** | **Average** | **St. Deviation** | **Median** | **Average** | **Median** |
| | 11.80 | 11.18 | 8.97 | 7.15 | 3.49 | 7.55 | 4.66 | 1.42 |

| | Perimeter Samples (<50 Miles) | | | Background Samples (>50 Samples) | | | E-B | E-B |
|---|---|---|---|---|---|---|---|---|
| Beta | **Average** | **St. Deviation** | **Median** | **Average** | **St. Deviation** | **Median** | **Average** | **Median** |
| | 11.06 | 4.84 | 8.83 | 11.86 | 5.55 | 11.80 | -0.79 | -2.60 |

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## Tables and Figures
## Surface Soil Monitoring

Table 3. Random SRS perimeter minus SC background averages for metals.

| | Perimeter Samples (<50 Miles) | | | Background Samples (>50 Miles) | | | E-B | E-B |
|---|---|---|---|---|---|---|---|---|
| | AVERAGE | ST. DEV. | MEDIAN | AVERAGE | ST. DEV. | MEDIAN | AVERAGE | MEDIAN |
| Aluminum | 12196.00 | 12613.47 | 6000.00 | 8744.44 | 7406.27 | 7900.00 | 3451.56 | -1900.00 |
| Barium | 85.50 | 70.02 | 69.00 | 51.71 | 26.55 | 63.00 | 33.79 | 6.00 |
| Beryllium | 1.42 | 0.97 | 1.15 | 0.38 | 0.02 | 0.38 | 1.02 | 0.77 |
| Cadium | NA | NA | NA | 9.30 | NA | 9.30 | NA | NA |
| Cobalt | 8.70 | 0.57 | 8.70 | 7.30 | 2.09 | 7.60 | 1.40 | 1.10 |
| Chromium | 16.42 | 14.92 | 12.50 | 8.99 | 5.84 | 7.50 | 7.43 | 5.00 |
| Copper | 10.10 | 10.04 | 4.60 | 7.43 | 6.06 | 6.35 | 2.67 | -1.75 |
| Iron | 10945.00 | 12088.79 | 5650.00 | 7374.29 | 5592.49 | 9400.00 | 3570.71 | -3750.00 |
| Magnesium | 743.83 | 994.84 | 182.50 | 786.00 | 785.83 | 670.00 | -42.17 | -487.50 |
| Manganese | 239.23 | 402.41 | 21.00 | 283.57 | 313.20 | 220.00 | -44.34 | -199.00 |
| Molybdenum | 2.10 | NA | 2.10 | NA | NA | NA | NA | NA |
| Nickel | 10.17 | 5.01 | 12.00 | 6.04 | 2.78 | 6.90 | 4.13 | 5.10 |
| Lead | 25.87 | 23.30 | 19.50 | 14.74 | 5.36 | 14.00 | 11.13 | 5.50 |
| Titanium | 274.67 | 300.83 | 99.00 | 205.86 | 209.34 | 82.00 | 68.81 | 17.00 |
| Vanadium | 28.04 | 23.90 | 18.00 | 13.04 | 10.73 | 9.70 | 15.00 | 8.30 |
| Zinc | 27.32 | 29.51 | 10.00 | 19.59 | 17.24 | 19.00 | 7.73 | -9.00 |

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### 3.1.4 Data
### Surface Soil Monitoring



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# Surface Soil Monitoring Data
# Gamma Data Random Perimeter Samples < 50 Miles from SRS

| Sample ID | SSE27 | SSE28 | SSE29 | SSE30 | SSE31 | SSE32 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | AIKEN | AIKEN | EDGEFIELD |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 18 APR 06 | 18 APR 06 | 05 APR 06 |
| Analysis Date | 11 APR 06 | 11 APR 06 | 12 APR 06 | 04 AUG 06 | 03 AUG 06 | 01 AUG 06 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.384 | 0.760 | 0.307 | 1.092 | 1.004 | 1.369 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.030 | 0.040 | 0.021 | 0.031 | 0.034 | 0.044 |
| K-40 | **11.760** | **1.238** | <MDA | **1.420** | <MDA | **11.320** |
| Confidence Interval (+/- 2 SD) | **0.919** | **0.548** | | **0.457** | | **1.092** |
| MDA | **0.222** | **0.347** | 0.192 | **0.308** | 0.288 | **0.320** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.025 | 0.045 | 0.021 | 0.038 | 0.037 | 0.050 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.042 | 0.070 | 0.030 | 0.087 | 0.078 | 0.121 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.027 | 0.039 | 0.020 | 0.032 | 0.029 | 0.042 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.074 | 0.085 | 0.050 | 0.096 | 0.086 | 0.123 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.030 | 0.052 | 0.026 | 0.052 | 0.046 | 0.067 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.078 | 0.140 | 0.064 | 0.209 | 0.176 | 0.257 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.057 | 0.118 | 0.048 | 0.217 | 0.182 | 0.277 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.061 | 0.097 | 0.051 | 0.102 | 0.091 | 0.109 |
| I-131 | <MDA | > 8 HLE | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 4.083 | NA | 2.410 | 8 HLE | 8 HLE | 8 HLE |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.026 | 0.046 | 0.021 | 0.039 | 0.033 | 0.042 |
| Cs-137 | **0.077** | **0.275** | **0.135** | **0.139** | **0.111** | **0.153** |
| Confidence Interval (+/- 2 SD) | **0.025** | **0.068** | **0.029** | **0.036** | **0.033** | **0.046** |
| MDA | **0.021** | **0.039** | **0.022** | **0.042** | **0.036** | **0.040** |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

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## Surface Soil Monitoring Data
## Gamma Data Random Perimeter Samples < 50 Miles from SRS

| Sample ID | SSE27 | SSE28 | SSE29 | SSE30 | SSE31 | SSE32 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | AIKEN | AIKEN | EDGEFIELD |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 18 APR 06 | 18 APR 06 | 05 APR 06 |
| Analysis Date | 11 APR 06 | 11 APR 06 | 12 APR 06 | 04 AUG 06 | 03 AUG 06 | 01 AUG 06 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.133 | 0.213 | 0.111 | 0.293 | 0.246 | 0.291 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.042 | 0.065 | 0.035 | 0.082 | 0.068 | 0.084 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.030 | 0.047 | 0.025 | 0.059 | 0.049 | 0.060 |
| Eu-155 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.062 | 0.082 | 0.049 | 0.075 | 0.067 | 0.110 |
| Pb-212 | <MDA | <MDA | <MDA | **2.437** | <MDA | **1.071** |
| Confidence Interval (+/- 2 SD) | | | | **0.227** | | **0.119** |
| MDA | 0.022 | 0.036 | 0.018 | **0.038** | 0.030 | **0.036** |
| Pb-214 | **0.731** | **1.351** | **0.423** | **1.382** | **1.020** | **0.804** |
| Confidence Interval (+/- 2 SD) | **0.062** | **0.105** | **0.045** | **0.101** | **0.083** | **0.092** |
| MDA | **0.039** | **0.064** | **0.037** | **0.067** | **0.061** | **0.073** |
| Ra-226 | **1.858** | **2.680** | <MDA | **2.963** | **2.220** | **2.772** |
| Confidence Interval (+/- 2 SD) | **0.505** | **0.796** | | **0.781** | **0.719** | **0.859** |
| MDA | **0.388** | **0.641** | 0.335 | **0.773** | **0.649** | **0.744** |
| Ac-228 | **0.656** | **1.197** | **0.384** | **2.328** | **1.077** | **0.945** |
| Confidence Interval (+/- 2 SD) | **0.080** | **0.124** | **0.066** | **0.151** | **0.116** | **0.134** |
| MDA | **0.094** | **0.141** | **0.077** | **0.128** | **0.113** | **0.152** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.269 | 0.471 | 0.214 | 0.436 | 0.386 | 0.591 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.049 | 0.075 | 0.041 | 0.075 | 0.063 | 0.070 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

## Surface Soil Monitoring Data
## Gamma Data Random Perimeter Samples < 50 Miles from SRS

| Sample ID | SSE33 | SSE34 | SSE35 | SSE36 | SSE37 | SSE38 |
|---|---|---|---|---|---|---|
| County | BARNWELL | LEXINGTON | AIKEN | ORANGEBURG | ALLENDALE | ALLENDALE |
| Collection Date | 20 SEP 06 | 24 AUG 06 | 24 AUG 06 | 18 DEC 06 | 18 DEC 06 | 18 DEC 06 |
| Analysis Date | 29 JAN 07 | 24 OCT 06 | 05 OCT 06 | 07 MAR 07 | 08 MAR 07 | 08 MAR 07 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.980 | 0.576 | 0.487 | 1.207 | 0.596 | 0.968 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.019 | 0.027 | 0.023 | 0.053 | 0.029 | 0.049 |
| K-40 | <MDA | **3.992** | **2.217** | **3.605** | <MDA | **7.921** |
| Confidence Interval (+/- 2 SD) | | **0.503** | **0.386** | **0.817** | | **1.004** |
| MDA | 0.388 | **0.220** | **0.180** | **0.571** | 0.265 | **0.420** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.028 | 0.033 | 0.028 | 0.065 | 0.036 | 0.053 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.064 | 0.045 | 0.039 | 0.102 | 0.054 | 0.079 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.019 | 0.025 | 0.022 | 0.054 | 0.029 | 0.046 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.065 | 0.074 | 0.065 | 1.749 E-01 | 0.079 | 0.120 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.040 | 0.033 | 0.026 | 0.077 | 0.044 | 0.059 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.152 | 0.100 | 0.079 | 0.202 | 0.117 | 0.169 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.209 | 0.079 | 0.073 | 0.189 | 0.098 | 0.155 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.069 | 0.093 | 0.077 | 0.166 | 0.082 | 0.130 |
| I-131 | 8HLE | <MDA | <MDA | 8HLE | 8HLE | 8HLE |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | | 6.053 | 5.283 | | | |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.024 | 0.033 | 0.028 | 0.072 | 0.032 | 0.048 |
| Cs-137 | **0.078** | **0.689** | **0.323** | **0.806** | <MDA | **0.857** |
| Confidence Interval (+/- 2 SD) | **0.026** | **0.079** | **0.044** | **0.088** | | **0.095** |
| MDA | **0.022** | **0.031** | **0.029** | **0.056** | 0.030 | **0.047** |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

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# Surface Soil Monitoring Data
# Gamma Data Random Perimeter Samples < 50 Miles from SRS

| Sample ID | SSE33 | SSE34 | SSE35 | SSE36 | SSE37 | SSE38 |
|---|---|---|---|---|---|---|
| County | BARNWELL | LEXINGTON | AIKEN | ORANGEBURG | ALLENDALE | ALLENDALE |
| Collection Date | 20 SEP 06 | 24 AUG 06 | 24 AUG 06 | 18 DEC 06 | 18 DEC 06 | 18 DEC 06 |
| Analysis Date | 29 JAN 07 | 24 OCT 06 | 05 OCT 06 | 07 MAR 07 | 08 MAR 07 | 08 MAR 07 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.271 | 0.308 | 0.255 | 0.389 | 0.193 | 0.290 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.075 | 0.099 | 0.084 | 0.115 | 0.059 | 0.087 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.050 | 0.071 | 0.061 | 0.083 | 0.042 | 0.062 |
| Eu-155 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.118 | 0.155 | 0.103 | 0.156 | 0.084 | 0.126 |
| Pb-212 | **1.558** | <MDA | **1.304** | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | **0.174** | | **0.151** | | | |
| MDA | **0.047** | 0.065 | **0.053** | 0.056 | 0.030 | 0.044 |
| Pb-214 | **0.938** | **1.590** | **0.868** | **5.892** | **0.548** | **1.433** |
| Confidence Interval (+/- 2 SD) | **0.081** | **0.130** | **0.084** | **0.269** | **0.068** | **0.104** |
| MDA | **0.050** | **0.068** | **0.058** | **0.110** | **0.057** | **0.085** |
| Ra-226 | **2.363** | **3.702** | **1.811** | **14.070** | <MDA | **3.028** |
| Confidence Interval (+/- 2 SD) | **0.615** | **0.847** | **0.653** | **1.887** | | **0.958** |
| MDA | **0.611** | **0.812** | **0.706** | **1.092** | 0.544 | **0.852** |
| Ac-228 | **1.616** | **1.678** | **1.250** | **1.422** | **0.961** | **1.360** |
| Confidence Interval (+/- 2 SD) | **0.104** | **0.128** | **0.106** | **0.196** | **0.100** | **0.150** |
| MDA | **0.073** | **0.106** | **0.085** | **0.208** | **0.106** | **0.165** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.503 | 0.811 | 0.677 | 0.631 | 0.453 | 0.525 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.179 | 0.247 | 0.204 | 0.129 | 0.061 | 0.095 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

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## Surface Soil Monitoring Data
## Gamma Data Random Background Samples > 50 Miles from SRS

| Sample ID | SSB25 | SSB26 | SSB27 | SSB28 | SSB29 | SSB30 |
|---|---|---|---|---|---|---|
| County | ORANGEBURG | JASPER | McCORMICK | WILLIAMSBURG | COLLETON | DILLON |
| Collection Date | 16 FEB 06 | 13 FEB 06 | 08 FEB 06 | 12 APR 06 | 11 APR 06 | 12 APR 06 |
| Analysis Date | 12 APR 06 | 12 APR 06 | 11 APR 06 | 03 AUG 06 | 01 AUG 06 | 02 AUG 06 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.345 | 0.316 | 0.271 | 1.022 | 1.168 | 1.478 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.022 | 0.019 | 0.020 | 0.025 | 0.039 | 0.045 |
| K-40 | <MDA | <MDA | **3.345** | <MDA | <MDA | **2.985** |
| Confidence Interval (+/- 2 SD) | | | **0.375** | | | **0.735** |
| MDA | 0.183 | 0.173 | **0.129** | 0.726 | 0.343 | **0.340** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.023 | 0.020 | 0.020 | 0.036 | 0.047 | 0.051 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.031 | 0.027 | 0.028 | 0.086 | 0.105 | 0.107 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.020 | 0.020 | 0.018 | 0.023 | 0.034 | 0.041 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.060 | 0.051 | 0.050 | 0.080 | 0.098 | 0.117 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.032 | 0.027 | 0.025 | 0.049 | 0.060 | 0.072 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.068 | 0.057 | 0.050 | 0.167 | 0.206 | 0.242 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.049 | 0.045 | 0.040 | 0.196 | 0.232 | 0.264 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.058 | 0.050 | 0.044 | 0.089 | 0.107 | 0.120 |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 2.114 | 2.301 | 3.030 | 8 HLE | 8 HLE | 8 HLE |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.026 | 0.019 | 0.018 | 0.029 | 0.039 | 0.048 |
| Cs-137 | <MDA | **0.099** | **0.113** | **0.138** | **0.281** | **0.484** |
| Confidence Interval (+/- 2 SD) | | **0.026** | **0.026** | **0.031** | **0.052** | **0.078** |
| MDA | 0.024 | **0.021** | **0.018** | **0.031** | **0.042** | **0.044** |

Notes:

1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** Back to 3.1.4 Soil Data

## Surface Soil Monitoring Data
## Gamma Data Random Background Samples > 50 Miles from SRS

| Sample ID | SSB25 | SSB26 | SSB27 | SSB28 | SSB29 | SSB30 |
|---|---|---|---|---|---|---|
| County | ORANGEBURG | JASPER | McCORMICK | WILLIAMSBURG | COLLETON | DILLON |
| Collection Date | 16 FEB 06 | 13 FEB 06 | 08 FEB 06 | 12 APR 06 | 11 APR 06 | 12 APR 06 |
| Analysis Date | 12 APR 06 | 12 APR 06 | 11 APR 06 | 03 AUG 06 | 01 AUG 06 | 02 AUG 06 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.133 | 0.110 | | 0.219 | 0.280 | 0.315 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.043 | 0.033 | 0.031 | 0.060 | 0.076 | 0.087 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.030 | 0.023 | 0.021 | 0.041 | 0.055 | 0.062 |
| Eu-155 | **0.124** | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | **0.040** | | | | | |
| MDA | **0.050** | 0.050 | 0.042 | 0.078 | 0.111 | 0.103 |
| Pb-212 | <MDA | <MDA | **0.329** | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | **0.042** | | | |
| MDA | 0.023 | 0.018 | **0.016** | 0.027 | 0.036 | 0.040 |
| Pb-214 | **0.568** | **0.397** | **0.239** | **0.220** | **0.645** | **1.071** |
| Confidence Interval (+/- 2 SD) | **0.056** | **0.042** | **0.035** | **0.055** | **0.083** | **0.106** |
| MDA | **0.038** | **0.032** | **0.030** | **0.060** | **0.072** | **0.081** |
| Ra-226 | **0.377** | <MDA | <MDA | <MDA | **3.103** | **2.713** |
| Confidence Interval (+/- 2 SD) | **0.497** | | | | **0.832** | **0.987** |
| MDA | **0.377** | 0.327 | 0.285 | 0.554 | **0.745** | **0.844** |
| Ac-228 | **0.743** | <MDA | <MDA | <MDA | **0.962** | <MDA |
| Confidence Interval (+/- 2 SD) | **0.079** | | | | **0.125** | |
| MDA | **0.084** | 0.137 | 0.121 | 0.205 | **0.140** | 0.320 |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.226 | 0.200 | 0.178 | 0.387 | 0.449 | 0.667 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.047 | 0.038 | 0.035 | 0.049 | 0.070 | 0.078 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

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# Surface Soil Monitoring Data
# Gamma Data Random Background Samples > 50 Miles from SRS

| Sample ID | SSB31 | SSB32 | SSB33 | SSB34 | SSB35 | SSB36 |
|---|---|---|---|---|---|---|
| County | JASPER | SALUDA | GREENWOOD | GREENWOOD | EDGEFIELD | ABBEVILLE |
| Collection Date | 21 SEP 06 | 20 SEP 06 | 18 SEP 06 | 07 DEC 06 | 07 DEC 06 | 07 DEC 06 |
| Analysis Date | 17 JAN 07 | 17 JAN 07 | 18 JAN 07 | 06 MAR 07 | 07 MAR 07 | 07 MAR 07 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.989 | 1.043 | 0.836 | 0.821 | 0.794 | 0.828 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.026 | 0.025 | 0.020 | 0.042 | 0.041 | 0.047 |
| K-40 | **6.416** | **5.946** | **5.124** | **9.788** | **6.609** | **18.730** |
| Confidence Interval (+/- 2 SD) | **0.609** | **0.600** | **0.458** | **0.999** | **0.763** | **1.538** |
| MDA | **0.185** | **0.199** | **0.149** | **0.298** | **0.268** | **0.274** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.033 | 0.032 | 0.026 | 0.041 | 0.039 | 0.049 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.067 | 0.074 | 0.057 | 0.071 | 0.071 | 0.084 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.021 | 0.023 | 0.019 | 0.040 | 0.038 | 0.039 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.073 | 0.075 | 0.058 | 0.109 | 0.104 | 0.122 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.040 | 0.043 | 0.031 | 0.056 | 0.049 | 0.051 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.152 | 0.160 | 0.132 | 0.157 | 0.151 | 0.175 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.187 | 0.214 | 0.171 | 0.136 | 0.140 | 0.148 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.081 | 0.084 | 0.068 | 0.090 | 0.087 | 0.093 |
| I-131 | 8HLE | 8HLE | 8HLE | 8HLE | 8HLE | 8HLE |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | | | | | | |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.026 | 0.030 | 0.022 | 0.035 | 0.037 | 0.036 |
| Cs-137 | <MDA | **0.315** | **0.092** | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | **0.046** | **0.026** | | | |
| MDA | 0.028 | **0.028** | **0.024** | 0.039 | 0.038 | 0.039 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

# Surface Soil Monitoring Data
# Gamma Data Random Background Samples > 50 Miles from SRS

| Sample ID | SSB31 | SSB32 | SSB33 | SSB34 | SSB35 | SSB36 |
|---|---|---|---|---|---|---|
| County | JASPER | SALUDA | GREENWOOD | GREENWOOD | EDGEFIELD | ABBEVILLE |
| Collection Date | 21 SEP 06 | 20 SEP 06 | 18 SEP 06 | 07 DEC 06 | 07 DEC 06 | 07 DEC 06 |
| Analysis Date | 17 JAN 07 | 17 JAN 07 | 18 JAN 07 | 06 MAR 07 | 07 MAR 07 | 07 MAR 07 |
| Analyte and Results | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.288 | 0.315 | 0.241 | 0.215 | 0.214 | 0.244 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.084 | 0.088 | 0.070 | 0.062 | 0.065 | 0.068 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.060 | 0.062 | 0.049 | 0.044 | 0.044 | 0.048 |
| Eu-155 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.122 | 0.124 | 0.098 | 0.072 | 0.089 | 0.095 |
| Pb-212 | <MDA | **0.645** | **0.674** | **0.117** | **0.125** | <MDA |
| Confidence Interval (+/- 2 SD) | | **0.087** | **0.084** | **0.035** | **0.028** | |
| MDA | 0.053 | **0.056** | **0.044** | **0.030** | **0.031** | 0.034 |
| Pb-214 | **0.681** | **0.556** | **0.654** | **0.356** | **0.599** | **0.606** |
| Confidence Interval (+/- 2 SD) | **0.075** | **0.071** | **0.062** | **0.062** | **0.073** | **0.076** |
| MDA | **0.057** | **0.061** | **0.046** | **0.061** | **0.061** | **0.065** |
| Ra-226 | **1.617** | **1.699** | **1.636** | <MDA | **1.425** | **1.896** |
| Confidence Interval (+/- 2 SD) | **0.682** | **0.712** | **0.598** | | **0.693** | **0.728** |
| MDA | **0.647** | **0.701** | **0.559** | 0.578 | **0.563** | **0.638** |
| Ac-228 | **0.928** | <MDA | **0.736** | <MDA | <MDA | **0.978** |
| Confidence Interval (+/- 2 SD) | **0.094** | | **0.075** | | | **0.131** |
| MDA | **0.089** | 0.186 | **0.073** | 0.225 | 0.232 | **0.143** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.540 | 0.674 | 0.519 | 0.464 | 0.345 | 0.409 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.193 | 0.205 | 0.152 | 0.063 | 0.066 | 0.074 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

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## Surface Soil Monitoring Data
## Gamma Data SRS Nonrandom Perimeter Samples

| Sample ID | SSBWL-001 | SSBWL-002 | SSBWL-003 | SSALD-001 | SSALD-002 | SSBWL-004 |
|---|---|---|---|---|---|---|
| County | BARNWELL | BARNWELL | BARNWELL | ALLENDALE | ALLENDALE | BARNWELL |
| Collection Date | 21 FEB 06 | 21 FEB 06 | 21 FEB 06 | 04 APR 06 | 04 APR 06 | 04 APR 06 |
| Analysis Date | 05 MAY 06 | 04 MAY 06 | 04 MAY 06 | 31 JUL 06 | 31 JUL 06 | 01 AUG 06 |
| Analyte and Results | | | | | | |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.336 | 0.473 | 0.412 | 0.938 | 2.099 | 1.160 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.021 | 0.027 | 0.020 | 0.026 | 0.049 | 0.034 |
| K-40 | <MDA | <MDA | **0.642** | <MDA | **12.210** | <MDA |
| Confidence Interval (+/- 2 SD) | | | **0.279** | | **1.106** | |
| MDA | 0.167 | 0.449 | **0.165** | 0.526 | **0.336** | 0.654 |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.021 | 0.032 | 0.027 | 0.034 | 0.050 | 0.047 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.033 | 0.048 | 0.037 | 0.066 | 0.116 | 0.084 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.017 | 0.024 | 0.021 | 0.022 | 0.041 | 0.031 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.053 | 0.078 | 0.057 | 0.079 | 0.134 | 0.101 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.026 | 0.040 | 0.029 | 0.047 | 0.077 | 0.069 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.069 | 0.100 | 0.080 | 0.165 | 0.260 | 0.213 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.053 | 0.078 | 0.062 | 0.188 | 0.383 | 0.239 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.048 | 0.074 | 0.054 | 0.076 | 0.170 | 0.092 |
| I-131 | >8 HLE | >8 HLE | >8 HLE | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | | | | 8HLE | 8 HLE | 8 HLE |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.020 | 0.033 | 0.023 | 0.030 | 0.053 | 0.038 |
| Cs-137 | <MDA | **0.061** | **0.077** | **0.076** | **6.161** | **0.185** |
| Confidence Interval (+/- 2 SD) | | **0.029** | **0.027** | **0.030** | **0.456** | **0.043** |
| MDA | 0.019 | **0.029** | **0.023** | **0.028** | **0.046** | **0.039** |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** Back to 3.1.4 Soil Data

# Surface Soil Monitoring Data
# Gamma Data SRS Nonrandom Perimeter Samples

| Sample ID | SSBWL-001 | SSBWL-002 | SSBWL-003 | SSALD-001 | SSALD-002 | SSBWL-004 |
|---|---|---|---|---|---|---|
| County | BARNWELL | BARNWELL | BARNWELL | ALLENDALE | ALLENDALE | BARNWELL |
| Collection Date | 21 FEB 06 | 21 FEB 06 | 21 FEB 06 | 04 APR 06 | 04 APR 06 | 04 APR 06 |
| Analysis Date | 05 MAY 06 | 04 MAY 06 | 04 MAY 06 | 31 JUL 06 | 31 JUL 06 | 01 AUG 06 |
| Analyte and Results | | | | | | |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.108 | 0.173 | 0.128 | 0.218 | 0.368 | 0.264 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.032 | 0.053 | 0.038 | 0.059 | 0.100 | 0.074 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.023 | 0.038 | 0.027 | 0.042 | 0.071 | 0.053 |
| Eu-155 | <MDA | <MDA | <MDA | **0.256** | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | **0.059** | | |
| MDA | 0.047 | 0.055 | 0.057 | **0.056** | 0.128 | 0.101 |
| Pb-212 | <MDA | **1.008** | **0.713** | <MDA | <MDA | **1.285** |
| Confidence Interval (+/- 2 SD) | | **0.486** | **0.076** | | | **0.636** |
| MDA | 0.018 | **0.028** | **0.021** | 0.027 | 0.043 | **0.035** |
| Pb-214 | **0.411** | **1.405** | **0.515** | **0.738** | **1.468** | **0.975** |
| Confidence Interval (+/- 2 SD) | **0.039** | **0.095** | **0.049** | **0.068** | **0.131** | **0.092** |
| MDA | **0.032** | **0.047** | **0.038** | **0.052** | **0.104** | **0.064** |
| Ra-226 | <MDA | **2.585** | **1.183** | **1.425** | **4.115** | **2.221** |
| Confidence Interval (+/- 2 SD) | | **0.641** | **0.409** | **0.563** | **1.069** | **0.839** |
| MDA | 0.315 | **0.474** | **0.361** | **0.554** | **0.959** | **0.687** |
| Ac-228 | **0.587** | **1.381** | **0.649** | **1.063** | **1.460** | **1.216** |
| Confidence Interval (+/- 2 SD) | **0.064** | **0.101** | **0.069** | **0.099** | **0.154** | **0.120** |
| MDA | **0.066** | **0.092** | **0.076** | **0.090** | **0.152** | **0.119** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.188 | 0.318 | 0.213 | 0.320 | 0.536 | 0.395 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.038 | 0.060 | 0.045 | 0.054 | 0.085 | 0.067 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables**

Back to 3.1.4 Soil Data

## Surface Soil Monitoring Data
## Gamma Data SRS Nonrandom Perimeter Samples

| Sample ID | SSAIK-001 | SSAIK-002 | SSAIK-003 | SSAIK-004 | SSAIK-005 | SSAIK-006 |
|---|---|---|---|---|---|---|
| County | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN |
| Collection Date | 23 AUG 06 | 23 AUG 06 | 23 AUG 06 | 04 DEC 06 | 04 DEC 06 | 04 DEC 06 |
| Analysis Date | 05 OCT 06 | 05 OCT 06 | 05 OCT 06 | 09 MAR 07 | 09 MAR 07 | 12 MAR 07 |
| Analyte and Results | | | | | | |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.282 | 0.318 | 0.338 | 1.048 | 0.942 | 0.744 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.014 | 0.017 | 0.017 | 0.044 | 0.035 | 0.030 |
| K-40 | <MDA | <MDA | **0.583** | **14.700** | <MDA | **1.000** |
| Confidence Interval (+/- 2 SD) | | | **0.244** | **1.305** | | **0.351** |
| MDA | 0.119 | 0.141 | **0.146** | **0.304** | 0.288 | **0.235** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.018 | 0.021 | 0.020 | 0.050 | 0.042 | 0.035 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.024 | 0.027 | 0.027 | 0.091 | 0.082 | 0.062 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.014 | 0.016 | 0.016 | 0.040 | 0.034 | 0.024 |
| Zn-65 | <MDA | <MDA | <MDA | **0.116** | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | **0.054** | | |
| MDA | 0.039 | 0.042 | 0.042 | **0.115** | 0.109 | 0.073 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.016 | 0.018 | 0.019 | 0.064 | 0.051 | 0.038 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.050 | 0.059 | 0.056 | 0.188 | 0.171 | 0.142 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.042 | 0.047 | 0.049 | 0.173 | 0.170 | 0.131 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.055 | 0.058 | 0.062 | 0.107 | 0.102 | 0.075 |
| I-131 | <MDA | <MDA | <MDA | 8HLE | 8HLE | 8HLE |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 1.518 | 1.720 | 2.198 | | | |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.018 | 0.020 | 0.020 | 0.046 | 0.046 | 0.032 |
| Cs-137 | **0.149** | <MDA | **0.357** | **0.486** | **0.450** | <MDA |
| Confidence Interval (+/- 2 SD) | **0.027** | | **0.046** | **0.077** | **0.068** | |
| MDA | **0.018** | 0.020 | **0.020** | **0.042** | **0.039** | 0.030 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** Back to 3.1.4 Soil Data

# Surface Soil Monitoring Data
# Gamma Data SRS Nonrandom Perimeter Samples

| Sample ID | SSAIK-001 | SSAIK-002 | SSAIK-003 | SSAIK-004 | SSAIK-005 | SSAIK-006 |
|---|---|---|---|---|---|---|
| County | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN |
| Collection Date | 23 AUG 06 | 23 AUG 06 | 23 AUG 06 | 04 DEC 06 | 04 DEC 06 | 04 DEC 06 |
| Analysis Date | 05 OCT 06 | 05 OCT 06 | 05 OCT 06 | 09 MAR 07 | 09 MAR 07 | 12 MAR 07 |
| Analyte and Results | | | | | | |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.177 | 0.201 | 0.193 | 0.276 | 0.026 | 0.199 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.058 | 0.066 | 0.067 | 0.081 | 0.077 | 0.061 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.039 | 0.046 | 0.046 | 0.057 | 0.055 | 0.044 |
| Eu-155 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.081 | 0.098 | 0.092 | 0.114 | 0.109 | 0.084 |
| Pb-212 | <MDA | **1.051** | **0.765** | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | **0.121** | **0.092** | | | |
| MDA | 0.037 | **0.042** | **0.042** | 0.039 | 0.040 | 0.030 |
| Pb-214 | **0.464** | **0.727** | **0.586** | **1.328** | **1.491** | **0.808** |
| Confidence Interval (+/- 2 SD) | **0.048** | **0.066** | **0.057** | **0.104** | **0.116** | **0.068** |
| MDA | **0.038** | **0.044** | **0.045** | **0.075** | **0.070** | **0.051** |
| Ra-226 | <MDA | **1.377** | <MDA | **3.560** | **2.838** | **1.681** |
| Confidence Interval (+/- 2 SD) | | **0.478** | | **0.929** | **0.968** | **0.706** |
| MDA | 0.480 | **0.555** | 0.526 | **0.747** | **0.728** | **0.557** |
| Ac-228 | **0.605** | **1.012** | **0.833** | **1.358** | **1.383** | **1.120** |
| Confidence Interval (+/- 2 SD) | **0.062** | **0.081** | **0.076** | **0.146** | **0.135** | **0.105** |
| MDA | **0.060** | **0.064** | **0.063** | **0.147** | **0.133** | **0.097** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.426 | 0.448 | 0.521 | 0.475 | 0.613 | 0.350 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.138 | 0.157 | 0.158 | 0.086 | 0.086 | 0.066 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

## Surface Soil Monitoring Data
## Gamma Data Nonrandom SC Background Samples > 50 Miles

| Sample ID | SSLEE-001 | SSRCH-001 | SSDIL-001 | SSLEE-002 | SSORG-001 | SSCAL-001 |
|---|---|---|---|---|---|---|
| County | LEE | RICHLAND | DILLON | LEE | ORANGEBURG | CALHOUN |
| Collection Date | 28 MAR 06 | 28 MAR 06 | 12 APR 06 | 12 APR 06 | 07 JUN 06 | 07 JUN 06 |
| Analysis Date | 9 MAY 06 | 9 MAY 06 | 02 AUG 06 | 03 AUG 06 | 04 AUG 06 | 08 AUG 06 |
| Analyte and Results | | | | | | |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.316 | 0.375 | 1.106 | 1.147 | 0.414 | 0.484 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.027 | 0.035 | 0.029 | 0.039 | 0.025 | 0.026 |
| K-40 | **4.703** | **7.098** | **2.356** | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | **0.595** | **0.698** | **0.474** | | | |
| MDA | **0.230** | **0.256** | **0.227** | 0.727 | 0.660 | 0.603 |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.030 | 0.032 | 0.039 | 0.040 | 0.031 | 0.030 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.035 | 0.041 | 0.085 | 0.087 | 0.045 | 0.040 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.027 | 0.030 | 0.033 | 0.034 | 0.026 | 0.023 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.070 | 0.075 | 0.102 | 0.097 | 0.063 | 0.067 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.031 | 0.036 | 0.061 | 0.063 | 0.034 | 0.032 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.068 | 0.073 | 0.198 | 0.218 | 0.086 | 0.090 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.045 | 0.053 | 0.216 | 0.230 | 0.063 | 0.076 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.068 | 0.074 | 0.096 | 0.104 | 0.078 | 0.079 |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.800 | 0.890 | 8 HLE | 8 HLE | 3.605 | 5.274 |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.032 | 0.031 | 0.039 | 0.041 | 0.027 | 0.031 |
| Cs-137 | **0.237** | **0.337** | **0.214** | **0.267** | **0.092** | **0.163** |
| Confidence Interval (+/- 2 SD) | **0.038** | **0.049** | **0.049** | **0.061** | **0.028** | **0.038** |
| MDA | **0.025** | **0.029** | **0.034** | **0.038** | **0.026** | **0.030** |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

# Surface Soil Monitoring Data
# Gamma Data Nonrandom SC Background Samples > 50 Miles

| Sample ID | SSLEE-001 | SSRCH-001 | SSDIL-001 | SSLEE-002 | SSORG-001 | SSCAL-001 |
|---|---|---|---|---|---|---|
| County | LEE | RICHLAND | DILLON | LEE | ORANGEBURG | CALHOUN |
| Collection Date | 28 MAR 06 | 28 MAR 06 | 12 APR 06 | 12 APR 06 | 07 JUN 06 | 07 JUN 06 |
| Analysis Date | 9 MAY 06 | 9 MAY 06 | 02 AUG 06 | 03 AUG 06 | 04 AUG 06 | 08 AUG 06 |
| Analyte and Results | | | | | | |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.147 | 0.154 | 0.255 | 0.281 | 0.180 | 0.195 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.048 | 0.053 | 0.069 | 0.078 | 0.055 | 0.062 |
| Eu-154 | <MDA | <MDA | < MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.033 | 0.037 | 0.050 | 0.055 | 0.041 | 0.044 |
| Eu-155 | <MDA | <MDA | <MDA | **0.410** | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | **0.088** | | |
| MDA | 0.069 | 0.074 | 0.067 | **0.079** | 0.073 | 0.081 |
| Pb-212 | <MDA | <MDA | <MDA | <MDA | <MDA | **0.820** |
| Confidence Interval (+/- 2 SD) | | | | | | **0.091** |
| MDA | 0.025 | 0.028 | 0.032 | 0.037 | 0.024 | **0.028** |
| Pb-214 | **1.168** | **0.900** | **0.876** | **1.111** | **0.369** | **0.687** |
| Confidence Interval (+/- 2 SD) | **0.082** | **0.077** | **0.087** | **0.097** | **0.054** | **0.063** |
| MDA | **0.047** | **0.051** | **0.063** | **0.068** | **0.049** | **0.057** |
| Ra-226 | **2.446** | **1.563** | **2.557** | **2.347** | <MDA | **2.124** |
| Confidence Interval (+/- 2 SD) | **0.567** | **0.485** | **0.858** | **0.706** | | **0.615** |
| MDA | **0.447** | **0.499** | **0.664** | **0.719** | 0.529 | **0.545** |
| Ac-228 | **0.833** | **0.811** | **1.242** | **1.483** | <MDA | **0.719** |
| Confidence Interval (+/- 2 SD) | **0.090** | **0.107** | **0.145** | **0.144** | | **0.092** |
| MDA | **0.093** | **0.106** | **0.115** | **0.125** | 0.196 | **0.100** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.274 | 0.296 | 0.389 | 0.457 | 0.399 | 0.347 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.055 | 0.060 | 0.064 | 0.072 | 0.048 | 0.055 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

# Surface Soil Monitoring Data
# Gamma Data Nonrandom SC Background Samples > 50 Miles

| Sample ID | SSJAS-001 | SSDAR-001 | SSKER-001 | SSDOR-001 | SSDOR-002 | SSLEX-001 |
|---|---|---|---|---|---|---|
| County | JASPER | DARLINGTON | KERSHAW | DORCHESTER | DORCHESTER | LEXINGTON |
| Collection Date | 09 AUG 06 | 27 SEP 06 | 13 DEC 06 | 20 DEC 06 | 20 DEC 06 | 21 DEC 06 |
| Analysis Date | 12 OCT 06 | 30 JAN 07 | 12 MAR 07 | 13 MAR 07 | 14 MAR 07 | 14 MAR 07 |
| Analyte and Results | | | | | | |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.509 | 0.935 | 0.988 | 0.748 | 0.643 | 1.182 |
| Na-22 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.024 | 0.019 | 0.041 | 0.033 | 0.027 | 0.062 |
| K-40 | **2.182** | **0.620** | **7.878** | <MDA | **2.123** | **7.641** |
| Confidence Interval (+/- 2 SD) | **0.422** | **0.259** | **0.884** | | **0.417** | **0.997** |
| MDA | **0.206** | **0.151** | **0.322** | 0.353 | **0.231** | **0.501** |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.029 | 0.026 | 0.050 | 0.039 | 0.034 | 0.070 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.041 | 0.063 | 0.086 | 0.064 | 0.054 | 0.110 |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.022 | 0.018 | 0.037 | 0.033 | 0.027 | 0.055 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.063 | 0.067 | 0.124 | 0.090 | 0.077 | 0.169 |
| Y-88 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.028 | 0.034 | 0.068 | 0.043 | 0.030 | 0.080 |
| Zr-95 | <MDA | <MDA | <MDA | | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.091 | 0.136 | 0.166 | 0.146 | 0.125 | 0.251 |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.080 | 0.186 | 0.171 | 0.127 | 0.106 | 0.212 |
| Sb-125 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.084 | 0.069 | 0.114 | 0.095 | 0.079 | 0.164 |
| I-131 | <MDA | 8HLE | 8HLE | 8HLE | 8HLE | 8HLE |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 7.130 | | | | | |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.028 | 0.025 | 0.046 | 0.041 | 0.032 | 0.069 |
| Cs-137 | **0.141** | **0.048** | **0.270** | **0.075** | **0.043** | **0.310** |
| Confidence Interval (+/- 2 SD) | **0.036** | **0.021** | **0.056** | **0.037** | **0.020** | **0.092** |
| MDA | **0.030** | **0.023** | **0.044** | **0.040** | **0.029** | **0.062** |

Notes:

1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

## Surface Soil Monitoring Data
## Gamma Data Nonrandom SC Background Samples > 50 Miles

| Sample ID | SSJAS-001 | SSDAR-001 | SSKER-001 | SSDOR-001 | SSDOR-002 | SSLEX-001 |
|---|---|---|---|---|---|---|
| County | JASPER | DARLINGTON | KERSHAW | DORCHESTER | DORCHESTER | LEXINGTON |
| Collection Date | 09 AUG 06 | 27 SEP 06 | 13 DEC 06 | 20 DEC 06 | 20 DEC 06 | 21 DEC 06 |
| Analysis Date | 12 OCT 06 | 30 JAN 07 | 12 MAR 07 | 13 MAR 07 | 14 MAR 07 | 14 MAR 07 |
| Analyte and Results | | | | | | |
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.273 | 0.271 | 0.266 | 0.223 | 0.193 | 0.397 |
| Eu-152 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.087 | 0.075 | 0.081 | 0.068 | 0.059 | 0.117 |
| Eu-154 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.062 | 0.050 | 0.058 | 0.049 | 0.041 | 0.084 |
| Eu-155 | <MDA | <MDA | <MDA | <MDA | **0.180** | **1.034** |
| Confidence Interval (+/- 2 SD) | | | | | **0.055** | **0.174** |
| MDA | 0.125 | 0.104 | 0.081 | 0.097 | **0.068** | **0.122** |
| Pb-212 | <MDA | **1.029** | <MDA | <MDA | <MDA | **3.014** |
| Confidence Interval (+/- 2 SD) | | **0.496** | | | | **0.276** |
| MDA | 0.055 | **0.048** | 0.040 | 0.033 | 0.029 | **0.060** |
| Pb-214 | **1.004** | **0.856** | **1.472** | **1.125** | **1.061** | **3.856** |
| Confidence Interval (+/- 2 SD) | **0.094** | **0.076** | **0.099** | **0.090** | **0.079** | **0.208** |
| MDA | **0.061** | **0.048** | **0.072** | **0.061** | **0.052** | **0.110** |
| Ra-226 | **2.362** | **1.539** | **1.944** | **1.571** | **2.702** | **7.179** |
| Confidence Interval (+/- 2 SD) | **0.667** | **0.576** | **0.788** | **0.661** | **0.749** | **1.498** |
| MDA | **0.725** | **0.609** | **0.765** | **0.624** | **0.533** | **1.107** |
| Ac-228 | **0.770** | **1.022** | **1.420** | **0.698** | **0.852** | **3.057** |
| Confidence Interval (+/- 2 SD) | **0.087** | **0.093** | **0.142** | **0.111** | **0.093** | **0.239** |
| MDA | **0.088** | **0.075** | **0.149** | **0.121** | **0.104** | **0.215** |
| Th-234 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.669 | 0.581 | 0.465 | 0.397 | 0.350 | 0.703 |
| Am-241 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Confidence Interval (+/- 2 SD) | | | | | | |
| MDA | 0.213 | 0.179 | 0.087 | 0.072 | 0.062 | 0.132 |

Notes:
1. Detects are in bold
2. "8 HLE" indicates 8 half lives have expired.
3. Shaded areas indicate no data collected.

**Back to List of Data Tables** **Back to 3.1.4 Soil Data**

# Surface Soil Monitoring Data
# Alpha Data

## Random Perimeter

| Sample Location: | SSE27 | SSE28 | SSE29 | SSE30 | SSE31 | SSE32 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | AIKEN | AIKEN | EDGEFIELD |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 18 APR 06 | 18 APR 06 | 05 APR 06 |
| Analysis Date | 17 OCT 06 | 17 OCT 06 | 17 OCT 06 | 20 OCT 06 | 20 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| UNCERTAINTY | | | | | | |
| LLD | 24.70 | 22.80 | 20.70 | 19.90 | 19.00 | 18.30 |
| Sample Location: | SSE33 | SSE34 | SSE35 | SSE36 | SSE37 | SSE38 |
| County | BARNWELL | LEXINGTON | AIKEN | ORANGEBURG | ALLENDALE | ALLENDALE |
| Collection Date | 20 SEP 06 | 24 AUG 06 | 24 AUG 06 | 18 DEC 06 | 18 DEC 06 | 18 DEC 06 |
| Analysis Date | 27 MAR 07 | 16 JAN 07 | 16 JAN 07 | 28 MAR 07 | 28 MAR 07 | 28 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **9.78** | **6.42** | **11.50** | **33.50** | **8.15** | **1.45** |
| UNCERTAINTY | **6.59** | **5.61** | **7.53** | **16.40** | **6.01** | **8.00** |
| LLD | **0.00** | **5.99** | **6.72** | **12.00** | **0.00** | **0.00** |

## Random Background

| Sample Location: | SSB25 | SSB26 | SSB27 | SSB28 | SSB29 | SSB30 |
|---|---|---|---|---|---|---|
| County | ORANGEBURG | JASPER | McCORMICK | WILLIAMSBURG | COLLETON | DILLON |
| Collection Date | 16 FEB 06 | 13 FEB 06 | 08 FEB 06 | 12 APR 06 | 11 APR 06 | 12 APR 06 |
| Analysis Date | 17 OCT 06 | 17 OCT 06 | 17 OCT 06 | 19 OCT 06 | 19 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| UNCERTAINTY | | | | | | |
| LLD | 25.00 | 23.50 | 24.00 | 19.90 | 20.20 | 19.30 |
| Sample Location: | SSB31 | SSB32 | SSB33 | SSB34 | SSB35 | SSB36 |
| County | JASPER | SALUDA | GREENWOOD | GREENWOOD | EDGEFIELD | ABBEVILLE |
| Collection Date | 21 SEP 06 | 20 SEP 06 | 18 SEP 06 | 07 DEC 06 | 07 DEC 06 | 07 DEC 06 |
| Analysis Date | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 | 28 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **6.78** | **3.57** | **1.26** | **8.38** | **3.22** | **8.32** |
| UNCERTAINTY | **5.59** | **4.16** | **7.38** | **6.18** | **3.75** | **6.14** |
| LLD | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

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# Surface Soil Monitoring Data
# Alpha Data

## Nonrandom Perimeter

| Sample Location: | SSBWL-003 | SSBWL-002 | SSBWL-001 | SSALD-001 | SSALD-002 | SSBWL-004 |
|---|---|---|---|---|---|---|
| County | BARNWELL | BARNWELL | BARNWELL | ALLENDALE | ALLENDALE | BARNWELL |
| Collection Date | 21 FEB 06 | 21 FEB 06 | 21 FEB 06 | 04 APR 06 | 04 APR 06 | 04 APR 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 18 OCT 06 | 19 OCT 06 | 19 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | <LLD | <LLD | <LLD | <LLD |
| UNCERTAINTY | | | | | | |
| LLD | 23.00 | 24.50 | 22.30 | 19.90 | 19.90 | 20.10 |

| Sample Location: | SSAIK-001 | SSAIK-002 | SSAIK-003 | SSAIK-004 | SSAIK-005 | SSAIK-006 |
|---|---|---|---|---|---|---|
| County | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN |
| Collection Date | 23 AUG 06 | 23 AUG 06 | 23 AUG 06 | 04 DEC 06 | 04 DEC 06 | 04 DEC 06 |
| Analysis Date | 16 JAN 07 | 16 JAN 07 | 16 JAN 07 | 28 MAR 07 | 28 MAR 07 | 28 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | **12.20** | **16.10** | **17.10** | **15.20** |
| UNCERTAINTY | | | **7.93** | **8.39** | **8.12** | **8.38** |
| LLD | 7.09 | 6.78 | **7.08** | **0.00** | **0.00** | **0.00** |

## Nonrandom Background

| Sample Location: | SSLEE-001 | SSRCH-001 | SSDIL-001 | SSLEE-002 | SSORG-001 | SSCAL-001 |
|---|---|---|---|---|---|---|
| County | LEE | RICHLAND | DILLON | LEE | ORANGEBURG | CALHOUN |
| Collection Date | 28 MAR 06 | 28 MAR 06 | 12 APR 06 | 12 APR 06 | 07 JUN 06 | 07 JUN 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 19 OCT 06 | 20 OCT 06 | 20 OCT 06 | 20 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | <LLD | <LLD | <LLD | |
| UNCERTAINTY | | | | | | |
| LLD | 23.20 | 21.20 | 19.40 | 17.60 | 20.00 | 19.60 |

| Sample Location: | SSJAS-001 | SSDAR-001 | SSKER-001 | SSDOR-001 | SSDOR-002 | SSLEX-001 |
|---|---|---|---|---|---|---|
| County | JASPER | DARLINGTON | KERSHAW | DORCHESTER | DORCHESTER | LEXINGTON |
| Collection Date | 09 AUG 06 | 20 SEP 06 | 13 DEC 06 | 20 DEC 06 | 20 DEC 06 | 21 DEC 06 |
| Analysis Date | 16 JAN 07 | 27 MAR 07 | 28 MAR 07 | 28 MAR 07 | 28 MAR 07 | 28 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **20.30** | **6.75** | **1.50E+01** | **4.84E+00** | **1.48E+01** | **1.50E+01** |
| UNCERTAINTY | **9.97** | **5.57** | **8.24E+00** | **4.61E+00** | **8.12E+00** | **8.23E+00** |
| LLD | **7.27** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

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## Surface Soil Monitoring Data
## Beta Data

### Random Perimeter

| Sample Location: | SSE27 | SSE28 | SSE29 | SSE30 | SSE31 | SSE32 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | AIKEN | AIKEN | EDGEFIELD |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 18 APR 06 | 18 APR 06 | 05 APR 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 18 OCT 06 | 20 OCT 06 | 20 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **19.4** | **7.89** | **6.24** | **11.3** | **8.45** | **16.1** |
| UNCERTAINTY | **3.31** | **2.66** | **2.56** | **2.64** | **2.36** | **2.94** |
| LLD | **4.24** | **4.24** | **4.25** | **3.63** | **3.45** | **3.63** |
| Sample Location: | SSE33 | SSE34 | SSE35 | SSE36 | SSE37 | SSE38 |
| County | BARNWELL | LEXINGTON | AIKEN | ORANGEBURG | ALLENDALE | ALLENDALE |
| Collection Date | 20 SEP 06 | 24 AUG 06 | 24 AUG 06 | 18 DEC 06 | 18 DEC 06 | 18 DEC 06 |
| Analysis Date | 26 MAR 07 | 16 JAN 07 | 16 JAN 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **8.22** | <LLD | **9.20E+00** | <LLD | **6.31** | **17.5** |
| UNCERTAINTY | **2.64** | | **2.77E+00** | | **2.50** | **3.18** |
| LLD | **4.06** | 4.22E+00 | **4.35E+00** | 8.66 | **4.02** | **4.04** |

### Random Background

| Sample Location: | SSB25 | SSB26 | SSB27 | SSB28 | SSB29 | SSB30 |
|---|---|---|---|---|---|---|
| County | ORANGEBURG | JASPER | McCORMICK | WILLIAMSBURG | COLLETON | DILLON |
| Collection Date | 16 FEB 06 | 13 FEB 06 | 08 FEB 06 | 12 APR 06 | 11 APR 06 | 12 APR 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 18 OCT 06 | 19 OCT 06 | 19 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | <LLD | <LLD | **4.05** | **9.77** | **12.8** |
| UNCERTAINTY | | | | **2.11** | **2.80** | **2.74** |
| LLD | 4.13 | 4.10 | 4.23 | **3.56** | **4.08** | **3.62** |
| Sample Location: | SSB31 | SSB32 | SSB33 | SSB34 | SSB35 | SSB36 |
| County | JASPER | SALUDA | GREENWOOD | GREENWOOD | EDGEFIELD | ABBEVILLE |
| Collection Date | 26 SEP 06 | 20 SEP 06 | 18 SEP 06 | 07 DEC 06 | 07 DEC 06 | 07 DEC 06 |
| Analysis Date | 26 MAR 07 | 26 MAR 07 | 26 MAR 07 | 26 MAR 07 | 26 MAR 07 | 26 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **13.50** | **11.80** | **10.40** | **7.38** | **12.70** | **24.30** |
| UNCERTAINTY | **3.01** | **5.16** | **2.79** | **2.56** | **2.69** | **3.38** |
| LLD | **4.13** | **8.45** | **4.08** | **4.02** | **3.65** | **3.79** |

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## Surface Soil Monitoring Data
## Beta Data

### Nonrandom Perimeter

| Sample Location: | SSBWL-003 | SSBWL-002 | SSBWL-001 | SSALD-001 | SSALD-002 | SSBWL-004 |
|---|---|---|---|---|---|---|
| County | BARNWELL | BARNWELL | BARNWELL | ALLENDALE | ALLENDALE | BARNWELL |
| Collection Date | 21 FEB 06 | 21 FEB 06 | 21 FEB 06 | 04 APR 06 | 04 APR 06 | 04 APR 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 18 OCT 06 | 19 OCT 06 | 19 OCT 06 | 19 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **5.33** | **14.3** | <LLD | **5.46** | **28.2** | **10.2** |
| UNCERTAINTY | **2.46** | **3.08** | | **2.20** | **3.48** | **2.62** |
| LLD | **4.16** | **4.32** | 4.27 | **3.55** | **3.53** | **3.72** |
| Sample Location: | SSAIK-001 | SSAIK-002 | SSAIK-003 | SSAIK-004 | SSAIK-005 | SSAIK-006 |
| County | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN |
| Collection Date | 23 AUG 06 | 23 AUG 06 | 23 AUG 06 | 04 DEC 06 | 04 DEC 06 | 04 DEC 06 |
| Analysis Date | 16 JAN 07 | 16 JAN 07 | 16 JAN 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | <LLD | **4.58E+00** | <LLD | **23.20** | **19.3** | **9.14** |
| UNCERTAINTY | | **2.39E+00** | | **3.58** | **3.33** | **2.75** |
| LLD | 4.15E+00 | **4.15E+00** | 4.34E+00 | **4.22** | **4.12** | **4.14** |

### Nonrandom Background

| Sample Location: | SSLEE-001 | SSRCH-001 | SSDIL-001 | SSLEE-002 | SSORG-001 | SSCAL-001 |
|---|---|---|---|---|---|---|
| County | LEE | RICHLAND | DILLON | LEE | ORANGEBURG | CALHOUN |
| Collection Date | 28 MAR 06 | 28 MAR 06 | 12 APR 06 | 12 APR 06 | 07 JUN 06 | 07 JUN 06 |
| Analysis Date | 18 OCT 06 | 18 OCT 06 | 19 OCT 06 | 20 OCT 06 | 20 OCT 06 | 20 OCT 06 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **11.50** | **9.52** | **11.5** | **9.70** | <LLD | **5.13** |
| UNCERTAINTY | **2.83** | **2.72** | **2.68** | **2.56** | | **2.11** |
| LLD | **4.15** | **4.15** | **3.67** | **3.64** | 3.59 | **3.43** |
| Sample Location: | SSJAS-001 | SSDAR-001 | SSKER-001 | SSDOR-001 | SSDOR-002 | SSLEX-001 |
| County | JASPER | DARLINGTON | KERSHAW | DORCHESTER | DORCHESTER | LEXINGTON |
| Collection Date | 09 AUG 06 | 27 SEP 06 | 13 DEC 06 | 20 DEC 06 | 20 DEC 06 | 21 DEC 06 |
| Analysis Date | 16 JAN 07 | 26 MAR 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 | 27 MAR 07 |
| UNITS | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g |
| RESULT | **5.32E+00** | <LLD | **17.10** | **4.69** | **8.21** | **33** |
| UNCERTAINTY | **2.48E+00** | | **2.99** | **2.38** | **2.59** | **3.84** |
| LLD | **4.24E+00** | 4.11 | **3.75** | **4.01** | **3.96** | **3.89** |

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# Surface Soil Monitoring Data
# Metals Data Random Perimeter Samples < 50 Miles from SRS

| Sample Location: | SSE27 | SSE28 | SSE29 | SSE30 | SSE31 | SSE32 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | AIKEN | AIKEN | EDGEFIELD |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 18 APR 06 | 18 APR 06 | 05 APR 06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **14000** | **30000** | **4000** | **7000** | **4300** | **23000** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **120** | **80** | **12** | **31** | **11** | **110** |
| Beryllium | **0.78** | **2.8** | <0.30 | <0.30 | <0.30 | **0.62** |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | **10** | **3.8** | <2.0 | <2.0 | <2.0 | **13** |
| Chromium | **15** | **48** | **3.1** | **13** | **3.7** | **17** |
| Copper | **12** | <1.0 | <1.0 | **2.9** | **1.7** | **17** |
| Iron | **13000** | **120000** | **1800** | **1500** | **2200** | **21000** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **2000** | **300** | **82** | **71** | **79** | **1700** |
| Manganese | **530** | <1.0 | **70** | **6.5** | **6.2** | **1200** |
| Molybdenum | <2.0 | **3.1** | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | **12** | **4.2** | <2.0 | <2.0 | <2.0 | **10** |
| Lead | **19** | **50** | **7.9** | **7.5** | <5.0 | **16** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **630** | **100** | **64** | **100** | **82** | **360** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | **28** | **6.8** | **4.2** | **11** | **5.2** | **28** |
| Zinc | **30** | **12** | **2.8** | **3.8** | **3.4** | **42** |

| Sample Location: | SSE33 | SSE34 | SSE35 | SSE36 | SSE37 | SSE38 |
|---|---|---|---|---|---|---|
| County | BARNWELL | LEXINGTON | AIKEN | ORANGEBURG | ALLENDALE | ALLENDALE |
| Collection Date | 20 SEP 06 | 24 AUG 06 | 24 AUG 06 | 12/18/06 | 12/18/06 | 12/18/06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | 3.8 |
| Aluminum | **2000** | **13000** | **7900** | **15000** | **460** | **36000** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **6.5** | **36** | **12** | **58** | <5.0 | **160** |
| Beryllium | <0.30 | <0.30 | <0.30 | **0.56** | <0.30 | **1.2** |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | **2.1** | <2.0 | <2.0 | <2.0 | **9.1** |
| Chromium | **6.0** | **11** | **7.2** | **12** | **1.1** | **38** |
| Copper | **5.4** | **7.4** | **4.4** | **4.6** | <1.0 | **22** |
| Iron | **2700** | **7200** | **5100** | **2100** | **270** | **28000** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **25** | **320** | **100** | **270** | **21** | **1700** |
| Manganese | **36** | **59** | **8.5** | **15** | **1.9** | **390** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | **3.4** | **2.5** | <2.0 | **4.5** | <2.0 | **14** |
| Lead | **6.0** | **40** | **13** | **27** | **9** | **69** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **45** | **69** | **54** | **120** | **78** | **610** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | <2.0 | **16** | **12** | **14** | <2.0 | **65** |
| Zinc | **3.5** | **26** | **6.1** | **10** | <1.0 | **60** |

Notes:
1. Detects are in bold
2. " mg/kg" is milligrams per kilogram of soil (ppm)

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# Surface Soil Monitoring Data
# Metals Data Random Background > 50 Miles from SRS

| Sample Location: | SSB25 | SSB26 | SSB27 | SSB28 | SSB29 | SSB30 |
|---|---|---|---|---|---|---|
| County | EDGEFIELD | AIKEN | ALLENDALE | WILLIAMSBURG | COLLETON | DILLON |
| Collection Date | 08 FEB 06 | 24 JAN 06 | 13 FEB 06 | 12 APR 06 | 11 APR 06 | 12 APR 06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **3900** | **4000** | **9800** | **13000** | **33000** | **15000** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **8.2** | **9.3** | **50** | **9.4** | **81** | **49** |
| Beryllium | <0.30 | <0.30 | **0.55** | <0.30 | **0.99** | **0.47** |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | **9.3** | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | <0.30 | **13** | <2.0 | <2.0 | <2.0 |
| Chromium | **3.0** | <10 | **29** | **8.4** | **24** | **10** |
| Copper | <1.0 | <1.0 | **8.2** | **1.4** | **5.0** | **3.8** |
| Iron | **1000** | <2.0 | **20000** | **3500** | **6200** | **5200** |
| Mercury | <0.10 | **3.6** | <0.10 | <0.10 | **0.15** | **0.11** |
| Magnesium | **61** | <1.0 | **760** | **260** | **890** | **340** |
| Manganese | **6.0** | **1800** | **640** | **4.1** | **5.7** | **22** |
| Molybdenum | <2.0 | <0.10 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | <2.0 | **120** | **4.1** | **3.0** | **5.5** | **3.7** |
| Lead | **9.2** | **6.4** | **19** | **10** | **43** | **18** |
| Antimony | <5.0 | <2.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <2.0 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **62** | **120** | **460** | **83** | **56** | **130** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | **3.6** | **4.9** | **44** | **9.9** | **22** | **15** |
| Zinc | **3.1** | **2.6** | **18** | **4.3** | **11** | **14** |

| Sample Location: | SSB31 | SSB32 | SSB33 | SSB34 | SSB35 | SSB36 |
|---|---|---|---|---|---|---|
| County | JASPER | SALUDA | GREENWOOD | GREENWOOD | EDGEFIELD | ABBEVILLE |
| Collection Date | 21 SEP 06 | 20 SEP 06 | 18 SEP 06 | 12/07/06 | 12/07/06 | 12/07/06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **4400** | **8500** | **6500** | **9100** | **8100** | **6900** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **21** | **66** | **69** | **73** | **79** | **67** |
| Beryllium | <0.30 | **0.33** | **0.33** | **0.41** | **0.38** | **0.37** |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | **8.6** | **12** | **6.8** | **4.6** | **9.4** |
| Chromium | **7.4** | **12** | **15** | **18** | **7.5** | **15** |
| Copper | **3.4** | **7.7** | **8.9** | **19** | **5.9** | **7.4** |
| Iron | **4800** | **11000** | **12000** | **15000** | **9400** | **12000** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **1600** | **880** | **590** | **1600** | **670** | **2100** |
| Manganese | **130** | **770** | **1000** | **220** | **520** | **400** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | **5.4** | **5.1** | **4.1** | **8.7** | **3.5** | **8.4** |
| Lead | **7.4** | **20** | **19** | **23** | **15** | **14** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **23** | **89** | **210** | **400** | **180** | **590** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | **6.4** | **16** | **36** | **33** | **13** | **21** |
| Zinc | **10** | **16** | **17** | **54** | **19** | **26** |

Notes:
1. Detects are in bold
2. " mg/kg" is milligrams per kilogram of soil (ppm)

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## Surface Soil Monitoring Data
## Metals Data Nonrandom SRS Perimeter Samples

| Sample Location: | SSBWL-001 | SSBWL-002 | SSBWL-003 | SSBWL-004 | SSALD-001 | SSALD-002 |
|---|---|---|---|---|---|---|
| County | BARNWELL | BARNWELL | BARNWELL | BARNWELL | ALLENDALE | ALLENDALE |
| Collection Date | 21 FEB 06 | 21 FEB 06 | 21 FEB 06 | 04 APR 06 | 04 APR 06 | 04 APR 06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **1900** | **3300** | **3200** | **6400** | **5400** | **67000** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | <5.0 | **18** | **18** | **20** | **14** | **130** |
| Beryllium | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 | **1.2** |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <10 | <1.0 |
| Cobalt | <2.0 | **4.6** | <2.0 | **2.2** | <2.0 | **16** |
| Chromium | <1.0 | **3.8** | **4.0** | **6.5** | **4.6** | **39** |
| Copper | <1.0 | <1.0 | **3.0** | **1.8** | **2.7** | **34** |
| Iron | **870** | **3600** | **1800** | **4300** | **2900** | **31000** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **43** | **38** | **120** | **120** | **120** | **1900** |
| Manganese | **8.7** | **230** | **100** | **66** | **59** | **1100** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | <2.0 | <2.0 | <2.0 | **2.1** | <2.0 | **17** |
| Lead | <5.0 | **6.3** | **6.2** | **8.4** | **10** | **35** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **42** | **50** | **59** | **100** | **110** | **940** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | <2.0 | <2.0 | **3.2** | **5.8** | **6.2** | **52** |
| Zinc | **1.8** | **4.5** | **5.9** | **6.6** | **6.7** | **65** |

| Sample Location: | SSAIK-001 | SSAIK-002 | SSAIK-003 | SSAIK-004 | SSAIK-005 | SSAIK-006 |
|---|---|---|---|---|---|---|
| County | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN | AIKEN |
| Collection Date | 23 AUG 06 | 23 AUG 06 | 23 AUG 06 | 12/04/06 | 12/04/06 | 12/04/06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **1700** | **2800** | **3000** | **20000** | **3300** | **6600** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **7.1** | **9.0** | **5.5** | **180** | **18** | **17** |
| Beryllium | <0.30 | <0.30 | <0.30 | **1.1** | <0.30 | <0.30 |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | <2.0 | <2.0 | **8.3** | <2.0 | <2.0 |
| Chromium | **1.6** | **2.5** | **2.0** | **31** | **3.4** | **13** |
| Copper | <1.0 | **2.0** | **1.6** | **20** | **1.3** | **2.6** |
| Iron | **780** | **1800** | **1800** | **24000** | **2400** | **8900** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **40** | **74** | **87** | **2300** | **95** | **77** |
| Manganese | **17** | **16** | **9.7** | **1000** | **27** | **1.5** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | **2.1** |
| Nickel | <2.0 | <2.0 | <2.0 | **12** | <2.0 | <2.0 |
| Lead | **5.1** | <5.0 | **11** | **31** | **12** | **7.2** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **29** | **45** | **85** | **710** | **68** | **62** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | <2.0 | 3.3 | **3.3** | **38** | **5.2** | **18** |
| Zinc | **2.5** | **4.2** | **5.8** | **59** | **5.3** | **2.3** |

Notes:
1. Detects are in bold
2. " mg/kg" is milligrams per kilogram of soil (ppm)

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# Surface Soil Monitoring Data
# Metals Data Nonrandom SC Background Samples

| Sample Location: | SSLEE-001 | SSRCH-001 | SSDIL-001 | SSLEE-002 | SSORG-001 | SSCAL-001 |
|---|---|---|---|---|---|---|
| County | LEE | RICHLAND | DILLON | LEE | ORANGEBURG | CALHOUN |
| Collection Date | 28 MAR 06 | 28 MAR 06 | 12 APR 06 | 12 APR 06 | 07 JUN 06 | 07 JUN 06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **10000** | **22000** | **27000** | **3000** | **630** | **3000** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **59** | **82** | **30** | **8.0** | <5.0 | 5.6 |
| Beryllium | **0.39** | **0.74** | **0.35** | <0.30 | <0.30 | <0.30 |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | **8.4** | **9.5** | **2.7** | <2.0 | <2.0 | <2.0 |
| Chromium | **11** | **24** | **17** | **2.6** | <1.0 | **2.6** |
| Copper | **10** | **19** | **2.6** | **1.5** | <1.0 | **1.0** |
| Iron | **8500** | **15000** | **8000** | **1400** | **300** | **1200** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **580** | **1600** | **370** | **110** | **22** | **84** |
| Manganese | **340** | **410** | **18** | **18** | **3.3** | **24** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | **4.3** | **11** | **5.5** | <2.0 | <2.0 | <2.0 |
| Lead | **20** | **29** | **16** | <5.0 | <5.0 | <5.0 |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <10 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **100** | **560** | **240** | **110** | **41** | **77** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | **17** | **26** | **24** | **4.1** | <2.0 | **2.6** |
| Zinc | **37** | **47** | **8.1** | **5.0** | <1.0 | **4.7** |

| Sample Location: | SSJAS-001 | SSDAR-001 | SSKER-001 | SSDOR-001 | SSDOR-002 | SSLEX-001 |
|---|---|---|---|---|---|---|
| County | JASPER | DARLINGTON | KERSHAW | DORCHESTER | DORCHESTER | LEXINGTON |
| Collection Date | 09 AUG 06 | 27 SEP 06 | 12/13/06 | 12/20/06 | 12/20/06 | 12/21/06 |
| Analyte and Results | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | **8200** | **5000** | **5900** | **2600** | **1400** | **7900** |
| Arsenic | <10 | <10 | <10 | <10 | <10 | <10 |
| Barium | **46** | **17** | **63** | **20** | **11** | **49** |
| Beryllium | <0.30 | <0.30 | **0.35** | <0.30 | <0.30 | <0.30 |
| Boron | <10 | <10 | <10 | <10 | <10 | <10 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | <2.0 | **8.4** | <2.0 | <2.0 | <2.0 |
| Chromium | **6.9** | **3.5** | **9.9** | **2.2** | **3.1** | **7.2** |
| Copper | **2.4** | **2.9** | **6.8** | <1.0 | **1.5** | **4** |
| Iron | **1400** | **2100** | **9900** | 1100 | **920** | **3300** |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Magnesium | **270** | **110** | **740** | **93** | **79** | **220** |
| Manganese | **3.5** | **43** | **820** | **3** | **12** | **10** |
| Molybdenum | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nickel | <2.0 | <2.0 | **6.9** | <2.0 | <2.0 | **2.7** |
| Lead | **22** | **12** | **14** | **8.6** | **8.6** | **20** |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 | <10 |
| Tin | <50 | <50 | <50 | <50 | <50 | <50 |
| Titanium | **26** | **110** | **80** | **53** | **56** | **82** |
| Thallium | <50 | <50 | <50 | <50 | <50 | <50 |
| Vanadium | **6.2** | **4.5** | **9.7** | **3.2** | **3.1** | **8.3** |
| Zinc | **4.0** | **6.1** | **20** | **4.3** | **6** | **7.8** |

Notes:
1. Detects are in bold
2. " mg/kg" is milligrams per kilogram of soil (ppm)

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## 3.1.5 Summary Statistics
## Surface Soil Monitoring Data
## Gamma Summary Statistics

### Random Perimeter Radiological

Summary Statistics (Detects Only)
2006 ESOP Random Soil Radiological Data
Perimeter Samples (<50 Miles)

| | Average | St. Dev | Median | Min | Max |
|---|---|---|---|---|---|
| K-40 | 5.434 | 4.315 | 3.799 | 1.238 | 11.760 |
| Cs-137 | 0.331 | 0.303 | 0.153 | 0.077 | 0.857 |
| Eu-155 | 0.099 | 0.035 | 0.094 | 0.049 | 0.156 |
| Pb-212 | 1.593 | 0.597 | 1.431 | 1.071 | 2.437 |
| Pb-214 | 1.415 | 1.457 | 0.979 | 0.423 | 5.892 |
| Ra-226 | 3.747 | 3.672 | 2.726 | 1.811 | 14.070 |
| Ac-228 | 1.239 | 0.507 | 1.224 | 0.384 | 2.328 |
| Alpha | 12.017 | 11.681 | 8.965 | 1.450 | 34.800 |
| Beta | 12.455 | 6.516 | 9.200 | 6.240 | 26.400 |

### Random Background Radiological

Summary Statistics (Detects Only)
2006 ESOP Random Soil Radiological Data
Background Samples (>50 Miles)

| | Average | St. Dev | Median | Min | Max |
|---|---|---|---|---|---|
| K-40 | 7.368 | 5.055 | 6.181 | 2.985 | 18.730 |
| Cs-137 | 0.217 | 0.148 | 0.138 | 0.092 | 0.484 |
| Eu-155 | 0.124 | | 0.124 | 0.124 | 0.124 |
| Pb-212 | 0.378 | 0.271 | 0.329 | 0.117 | 0.674 |
| Pb-214 | 0.549 | 0.230 | 0.584 | 0.220 | 1.071 |
| Ra-226 | 2.013 | 0.637 | 1.699 | 0.377 | 3.103 |
| Ac-228 | 0.869 | 0.120 | 0.928 | 0.736 | 0.978 |
| Alpha | 7.145 | 3.492 | 7.550 | 3.220 | 12.600 |
| Beta | 11.856 | 5.552 | 11.800 | 4.050 | 24.300 |

### NonRandom Perimeter Radiological

Summary Statistics (Detects Only)
2006 ESOP Non-random Soil Radiological Data
Perimeter Samples (<50 Miles)

| | Average | St. Dev | Median | Min | Max |
|---|---|---|---|---|---|
| K-40 | 5.827 | 7.021 | 1.000 | 0.583 | 14.700 |
| Zn-65 | 0.116 | NA | 0.116 | 0.116 | 0.116 |
| Cs-137 | 0.889 | 1.984 | 0.185 | 0.061 | 6.161 |
| Eu-155 | 0.256 | | 0.256 | 0.256 | 0.256 |
| Pb-212 | 0.964 | 0.232 | 1.008 | 0.713 | 1.285 |
| Pb-214 | 0.910 | 0.411 | 0.773 | 0.411 | 1.491 |
| Ra-226 | 2.332 | 1.031 | 2.221 | 1.183 | 4.115 |
| Ac-228 | 1.055 | 0.322 | 1.092 | 0.587 | 1.460 |
| Alpha | 15.150 | 2.114 | 15.650 | 12.200 | 17.100 |
| Beta | 13.301 | 8.551 | 10.200 | 4.580 | 28.200 |

### Nonrandom Background Radiological

Summary Statistics (Detects Only)
2006 ESOP Non-random Soil Radiological Data
Background Samples (>50 Miles)

| | Average | St. Dev | Median | Min | Max |
|---|---|---|---|---|---|
| K-40 | 4.325 | 2.891 | 3.530 | 0.620 | 7.878 |
| Cs-137 | 0.183 | 0.104 | 0.188 | 0.043 | 0.337 |
| Eu-155 | 0.541 | 0.442 | 0.410 | 0.180 | 1.034 |
| Pb-212 | 1.621 | 1.211 | 1.029 | 0.820 | 3.014 |
| Pb-214 | 1.207 | 0.877 | 1.033 | 0.369 | 3.856 |
| Ra-226 | 2.576 | 1.582 | 2.347 | 1.539 | 7.179 |
| Ac-228 | 1.173 | 0.684 | 0.852 | 0.698 | 3.057 |
| Alpha | 12.782 | 5.829 | 14.900 | 4.840 | 20.300 |
| Beta | 11.567 | 8.411 | 9.610 | 4.690 | 33.000 |

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# Surface Soil Monitoring Data
# Metals Summary Statistics

Summary Statistics (Detects only)
2006 ESOP All Soil Metals Data
Perimeter Samples (<50 Miles)

| | AVERAGE | ST. DEV. | MEDIAN | MIN | MAX |
|---|---|---|---|---|---|
| Aluminum | 12196.00 | 12613.47 | 6000.00 | 460.00 | 36000.00 |
| Barium | 85.50 | 70.02 | 69.00 | 17.00 | 180.00 |
| Beryllium | 1.42 | 0.97 | 1.15 | 0.56 | 2.80 |
| Cobalt | 8.70 | 0.57 | 8.70 | 8.30 | 9.10 |
| Chromium | 16.42 | 14.92 | 12.50 | 1.10 | 38.00 |
| Copper | 10.10 | 10.04 | 4.60 | 1.30 | 22.00 |
| Iron | 10945.00 | 12088.79 | 5650.00 | 270.00 | 28000.00 |
| Magnesium | 743.83 | 994.84 | 182.50 | 21.00 | 2300.00 |
| Manganese | 239.23 | 402.41 | 21.00 | 1.50 | 1000.00 |
| Molybdenum | 2.10 | | 2.10 | 2.10 | 2.10 |
| Nickel | 10.17 | 5.01 | 12.00 | 4.50 | 14.00 |
| Lead | 25.87 | 23.30 | 19.50 | 7.20 | 69.00 |
| Titanium | 274.67 | 300.83 | 99.00 | 62.00 | 710.00 |
| Vanadium | 28.04 | 23.90 | 18.00 | 5.20 | 65.00 |
| Zinc | 27.32 | 29.51 | 10.00 | 2.30 | 60.00 |

Summary Statistics (Detects only)
2006 ESOP All Soil Metals Data
Background Samples (>50 Miles)

| | AVERAGE | ST. DEV. | MEDIAN | MIN | MEDIAN |
|---|---|---|---|---|---|
| Aluminum | 8744.44 | 7406.27 | 7900.00 | 1400.00 | 27000.00 |
| Barium | 51.71 | 26.55 | 63.00 | 11.00 | 79.00 |
| Beryllium | 0.38 | 0.02 | 0.38 | 0.35 | 0.41 |
| Cadium | 9.30 | | 9.30 | 9.30 | 9.30 |
| Cobalt | 7.30 | 2.09 | 7.60 | 4.60 | 9.40 |
| Chromium | 8.99 | 5.84 | 7.50 | 2.20 | 18.00 |
| Copper | 7.43 | 6.06 | 6.35 | 1.50 | 19.00 |
| Iron | 7374.29 | 5592.49 | 9400.00 | 920.00 | 15000.00 |
| Magnesium | 786.00 | 785.83 | 670.00 | 79.00 | 2100.00 |
| Manganese | 283.57 | 313.20 | 220.00 | 3.00 | 820.00 |
| Nickel | 6.04 | 2.78 | 6.90 | 2.70 | 8.70 |
| Lead | 14.74 | 5.36 | 14.00 | 8.60 | 23.00 |
| Titanium | 205.86 | 209.34 | 82.00 | 53.00 | 590.00 |
| Vanadium | 13.04 | 10.73 | 9.70 | 3.10 | 33.00 |
| Zinc | 19.59 | 17.24 | 19.00 | 4.30 | 54.00 |

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**Back to 3.1.4 Soil Data**

## 3.2 Radiological Monitoring of Terrestrial Vegetation On and Adjacent to SRS

### 3.2.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) monitors for the presence of radionuclides in vegetation around the Savannah River Site (SRS). In 2006, ESOP conducted independent vegetation monitoring at 17 locations around the perimeter of the SRS; three former SRS monitoring locations 25 miles from the center of SRS (Map 9, section 3.2.2); and 24 locations selected at random. Sampling was performed quarterly in February, May, August, and November. Additional random and nonrandom sampling of fungi was performed to monitor the bioconcentration of select radioisotopes in the environment (Map 1, page xiii).

Samples from 16 perimeter stations were analyzed for tritium activity, all of which exhibited tritium levels greater than the Lower Limit of Detection (LLD). Average activity levels were fairly uniform around SRS, with the highest activity located on the western side. Vegetation was collected for gamma analysis at eight selected perimeter stations where sampling had consistently shown detectable levels of cesium-137 (Cs-137), and one station added in 2005. Cesium-137 was detected at all but one of these locations, with the highest activities from stations on the northern side of the SRS.

ESOP added fungi sampling to the vegetation project in 2004. Evidence from European studies of the Chernobyl meltdown radioactive releases indicated that fungi are the greatest bioconcentrators of many heavy metal radionuclides. Also, a Department of Energy – Savannah River (DOE-SR) survey of fungi noted that Cs-137 concentration fluctuation in deer may be related to the availability of fungi. Fungi were collected at 25 random and one non-random location in 2006 (Map 1, page xiii).

**RESULTS AND DISCUSSION**

Results from all vegetation analyses, listed by station and date, are included in section 3.2.4. Results of gamma analysis of fungi are in section 3.2.4. Summary statistics for vegetation and fungi are presented in section 3.2.5.

<u>Tritium in Vegetation</u>

Tritium was detected in vegetation from all 16 of the perimeter sites sampled in 2006. Ten of the stations exhibited tritium levels greater than the LLD in all four sampling months. The highest tritium level in 2006, 2429 pCi/L, occurred in February on the west side of SRS at station BWL-009. This station also had the highest activity level in August**,** 1512 pCi/L. Station AKN-003, on the northwest side of SRS, produced the highest levels in May and November, 1858 pCi/L and 1749 pCi/L, respectively.

Tritium was detected at two of the three 25-mile radius stations, three times at Langley, and twice at the station in Springfield. Two randomly selected stations within 50 miles of SRS, in

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Orangeburg and Barnwell Counties, exhibited detectable tritium activity. No background sample exhibited tritium activity above the LLD.

The four highest quarterly tritium activities in 2006 were from sites on the western side of the SRS, in the vicinity of D-Area and Plant Vogtle. Station BWL-008 in this area also produced activities over 1000 piC/L. This is similar to results from 2002 through 2005 sampling (Figure 1, section 3.2.3). The Heavy Water Facility in D-Area processed residual heavy water from reactor operations and other DOE-SR sites activities through 1998 (WSRC 2000a). Residual tritium from releases at this facility may be partly responsible for higher tritium levels in the nearby vegetation. Tritium releases from the nearby Vogtle Electric Generating Plant in Georgia may also account for elevated tritium levels in this area of the SRS.

Two stations on the east side of SRS also exhibited relatively high tritium activities in 2006. A tritium activity over 2000 pCi/L was detected at AKN-007, and tritium levels at BWL-004 averaged over 1000 pCi/L. These results underscore the variability of tritium occurrence around SRS.

Tritium analysis results from ESOP and DOE-SR sampling are presented in in section 3.2.3, Table 1. Data comparison of associated locations from the two programs was conducted by converting SRS reported activity levels. However, differences between the two programs in sampling dates, the vegetation sampled, and analysis methods should be considered during comparison. Results from the two colocations were less than the detection limit for the DOE-SR program , while ESOP had detections of 601 pCi/L and 976 pCi/L at those locations. The DOE-SR program detected tritium from two perimeter stations in 2006; tritium was detected at similar times in samples from eight comparable stations by the ESOP program. Average tritium levels at the stations in Table 3 were compared, using only detections to calculate averages. The DOE-SR average (600 ± 122 pCi/L) was within one standard deviation of the ESOP average (717 ± 466 pCi/L).

The SAS™ NPAR1WAY Wilcoxon Rank Sum (WRS), median, Van der Waerden, modified Quantile and Savage two-sample tests were performed on the random sample results of relevant radionuclides in 2006, and for 2004-2006. The null hypothesis assumption was that for the radiocuclide tested, the SRS 50-mile perimeter sample population was the same as the South Carolina background population at the 1% significance level with respect to location distribution. Tritium comparisons of multi-year samples were conducted at the 1% significance level due to the decay percentage range for the time period specified and the short half-life of tritium. The assumption of uniform aerial deposition is a weak point in the analysis. Nonparametric tests are preferred even if the condition of normality was met due to the high efficiency of the combined tests for hypothesis testing, especially where nondetects are a large percent of the highly skewed data. The focus for comparison of the populations shifts from parameters to distribution shape and location. The tritium null hypothesis was not rejected at the 1% significance level for both the WRS and modified Quantile tests of the 2006 tritium data. However, the tritium null hypothesis was rejected at the 1% significance level for all the tests listed above when the data for 2004 through 2006 were combined (three-year basis random sampling). This indicated there was a significant difference in the tritium levels in vegetation between the two populations.
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However, a power calculation reference (NFEC 1999) involving the medians indicated that many more samples were needed to support the alternate hypothesis that the SRS 50-Mile Perimeter and South Carolina Background tritium populations were different with respect to tritium. Future analyses of additional random sampling are required to improve the power of the hypothesis test for tritium in vegetation before concluding that the populations are different.

Gamma in Vegetation

The naturally occurring isotopes beryllium-7 (Be-7) and potassium-40 (K-40) were detected from all stations where gamma samples were collected in 2006. Because these are naturally occurring isotopes the results will not be discussed in this report, but are presented in section 3.2.4.

Cesium-137 was detected at eight of nine perimeter stations sampled in 2006, and all eight stations produced Cs-137 results greater than the Minimum Detectable Activity (MDA) in all four months. AKN-003 exhibited the highest Cs-137 activity in February, 0.913 pCi/g. AKN-005 exhibited the highest activity in May and November, 0.712 pCi/g and 0.6851 pCi/g, respectively. AKN-008 had the highest August activity, 0.9233 pCi/g, which was the highest activity for 2006.

One randomly selected station in Orangeburg county within 50 miles of SRS exhibited Cs-137 activity above the MDA. Two random background samples, from Saluda and Greenwood counties, exhibited detectable Cs-137 activity.

Results of analysis for Cs-137 followed established trends in 2006. Stations around the perimeter of SRS selected for sampling because of continued Cs-137 detections again produced detectable activity, with the exception of AKN-002. AKN-005 on the north side of the SRS exhibited the highest average activity for 2006, and has consistently produced relatively high Cs-137 activity in previous sampling years section 3.2.3, Figure 2. A new station was added west of AKN-005 in 2005 to document CS-137 activities in this area near New Ellenton. This station, AKN-008, exhibited the highest monthly detection and second-highest average in 2006. Three stations on the southeast side of the SRS produced Cs-137 activity in all samples collected in 2006, while two stations from the northwest area of SRS exhibited detectable Cs-137 in all samples. These results are consistent with the results reported from 1998-2005.

Gamma analysis results for Cs-137 from ESOP and DOE-SR sampling in 2006 are presented in section 3.2.3, Table 2. The air station on Patterson Mill Road, a colocation between the two programs, exhibited similar results for both programs (0.193 pCi/g, ESOP; 0.066 pCi/g, DOE-SR) as it had in most previous years. Another colocation at the Allendale Gate, reinstated by DOE-SR in 2004, produced dissimilar results (0.695 pCi/g, ESOP; 0.112 pCi/g, DOE-SR). Differences in analysis and sampling methods (e.g., ESOP collects leaves from trees, whereas DOE-SR collects grass) may account for this disparity. For the other DOE-SR stations, the closest ESOP stations were selected for comparison. For the most part, DOE-SR and ESOP data were similar, with less than 0.5 pCi/g difference, including for the East Talatha station and AKN-005, which is approximately two miles east of New Ellenton. AKN-005 has consistently

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exhibited Cs-137 activity, usually the highest activity of the sites around SRS, while the East Talatha location produced the highest DOE-SR result in 2006. Average Cs-137 levels at the stations in Table 2 were compared, using only detections to calculate averages. The DOE-SR average (0.158 ± 0.083 pCi/g) was within one standard deviation of the ESOP average (0.335 ± 0.238 pCi/g).

The same statistical tests were performed on the Cs-137 data as for tritium. These tests were performed on the random sample results in 2006 using the null hypothesis that for Cs-137 the SRS environmental population was the same as the South Carolina background population at the

1% significance level. This hypothesis was not rejected, indicating that the SRS contribution to Cs-137 levels in nearby vegetation was not statistically significant. The random Cs-137 data cannot be compared on a three-year basis since the 2004 data were analyzed dry and the 2005 and 2006 data were analyzed wet. The results of a two-year comparison under the same null hypothesis did not reject the null hypothesis.

Gamma in Fungi

Six out of 24 radioisotopes surveyed were detected in mixed-fungi samples collected throughout South Carolina (SRS perimeter included) in 2006. The radioisotopes found in the SRS 50-Mile perimeter fungi included Be-7, K-40, Cs-137, lead-212 (Pb-212), Pb-214, and radium-226 (Ra-226) (section 3.2.4). Only five radioisotopes were found in fungi in the South Carolina background quadrants (Be-7, K-40, Cs-137, Pb-212 and Pb-214).

Subtraction of the 2006 South Carolina average random background concentrations left only Pb-214 and radium-226 above the 2006 average background (section 3.2.4). Subtraction of the median background concentrations indicated the same radioisotopes with the exception of the addition of Cs-137 (0.02 pCi/g above background). Beryllium-7 (tritium process), and Pb-212 (probable natural thorium-232 decay) half-lifes were too short to have come from SRS reactor output since they were no longer in operation. Diffuse and fugitive releases were not detected in 2006 by DOE-SR. A single nonrandom sample detected K-40, Cs-137, and Pb-214, but only Pb-214 was greater than the 2006 South Carolina background average.

Cesium-137 (half-life is 30.2 yrs.) was detected at 21 locations in 2006, and reflects the importance of Cs-137 bioconcentration in fungi (Botsch 1999). The lowest South Carolina background Cs-137 concentration detection in fungi (0.14 pCi/g) occurred in E37, the Sycamore quadrant. Compare this to the 23X higher (fungi versus soil project) detection (3.15 pCi/g) that occurred in the B28 Lake City West quadrant outside of the SRS 50-Mile Perimeter. Also, a comparison of the average Cs-137 activity concentrations for the same random quadrants indicated a consistently higher average for fungi versus soil, whether in the South Carolina random background or the SRS 50-mile perimeter (South Carolina background e.g., 0.898 pCi/g fungi v. 0.226 pCi/g soil project). The highest 2006 detection of Cs-137 (2.14 pCi/g) in mixed fungi was less than the 1986 concentrations found in wild *Boletus* (3.75 pCi/g) and *Russula* (3.66 pCi/g) species by the Vermont State Environmental Radiation Surveillance Program (RADNET 2006). This difference may represent depositional track concentrations related to global fallout

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and not necessarily local nuclear power sources since past ESOP detections have ranged up to 6.71 pCi/g. The SRS perimeter Cs-137 average (0.78 pCi/g) was less than background for fungi in 2006 (section 3.2.5, 0.83 pCi/g), but the median was slightly higher than background (0.02 pCi/g). However, the SRS perimeter average (0.78 pCi/g) was greater than the 2006 Surface Soil Project random background average for Cs-137 (SCDHEC 2006b, 0.22 pCi/g) in the same quadrants, and greater than the nonrandom 2006 background soil average (SCDHEC 2006b, 0.18 pCi/g). This indicated a potential bioconcentration of Cs-137 by a factor of four in mixed-fungi relative to soil background concentrations (Seel 1995).

Comparison of Cs-137 averages around SRS based on South Carolina geographical regions was a more specific indicator of possible SRS influence. The 2004-2006 Cs-137 concentration trend increased as the comparison becomes more specific on a regional basis (1.19 pCi/g within the total 50-mile SRS perimeter, and 1.26 pCi/g for the South Carolina Coastal Plain Region alone, and 1.30 pCi/g for the Upper Coastal Plain alone, which was most specific for the SRS area). It was not possible to determine if this was due to nuclear reactor operation, fallout from past atomic tests, or both, since the radioactive clouds from many of these tests did track over South Carolina.

Random radioisotope maximum concentrations in 2006 found in fungi included potential naturally occurring radioactive material (NORM); Be-7 (5.47 pCi/g), found in the Parksville B27 quadrant; K-40 (15.26 pCi/g), found in the B30 Oak Grove Quadrant; Pb-212 (0.16 pCi/g), found in the B27 Parksville Quadrant (thorium-232 or Th-232 series NORM); Pb-214 (2.23 pCi/g), probable NORM found in the E28 Salley Quadrant (uranium-238 or U-238 series NORM) and plutonium-238 or Pu-238 series product); Cs-137 (3.15 pCi/g), found in the B28 Lake City West Quadrant; and Ra-226 (4.16 pCi/g) found in the E28 Salley Quadrant (U-238 and Pu-238 series product**).** The U-238 and Pu-238 series both lead to the U-234 decay path and are indistinguishable except for Th-234 and palladium-234m (Pa-234m), which are short-lived and not detectable within the sample due to analysis time. However, given the location and the lack of an SRS-indicated release, even in the diffuse category, this was probable NORM.

The “B” samples were background and not likely of SRS origin, especially if not detected within 50-miles of SRS, and if the half-life was approximately less than 10 years (due to the lack of SRS reactor operations during that time period and the MDA for the radionuclide). The Pb-214 and Ra-226 from the same sample are found in the U-238 decay series (NORM) and were probably brought to the surface via well water from aquifers down gradient of Piedmont granite saprolitic material. The B28 Lake City West Quadrant Cs-137 detection was in a floodplain of Kingstree Swamp Canal. The amount of Cs-137 contamination due to SRS production activities was unknown since other sources deposited Cs-137 in South Carolina. Historical nuclear bomb atmospheric testing and accidental releases in the 1950s and 1960s probably contributed some of the detected Cs-137 (a fission product of commercial reactors as well).

Other radionuclides detected in previous years (europium-155 or Eu-155, cobalt-58 or Co-58 and Co-60, and actinium-228 or Ac-228) were not detected in the 2006 SRS random and nonrandom environmental perimeter samples. The SRS reactors have not been in operation since a 1992 test run of one reactor.

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South Carolina has three distinct geographic regions with distinct soil types containing different natural radioisotope concentrations. Since the SRS 50-mile perimeter contains mostly coastal plain type soils, a comparison of only those quadrants within the coastal plain should be more definitive by reducing extremes due to other soil types. A comparison of the 2004-2006 All South Carolina Region and Coastal Plain Region quadrants showed different average results when the respective backgrounds were subtracted (Table 3, section 3.2.3).

The accumulation of water soluble Ra-226 levels in coastal plain soils may be related to the distance from the saprolitic granite sources in the Piedmont and the effect of mixing in downstream aquifers. Potassium compounds are generally soluble in cold water and would accumulate down-gradient. Lead-212 comes from the Th-232 series and Pb-214 comes from the Th-234 series and U-238, which also decays to the Th-230 line. The persistence of insoluble Pb-

214 over insoluble Pb-212 in down-gradient sediments was uncertain, but possibly reflects the shorter overall decay chain life of Pb-212 (E10+) over Pb-214 (E12+) in relation to the abundance of the parent material.

Statistical tests of the South Carolina background and SRS 50-mile perimeter populations were applied to the 2004 through 2006 data for radionuclides of concern to test the null hypothesis that the two populations of specific radionuclides were of the same distribution shape and location (U.S. EPA 2000c).

Cesium-137 was detected at 21 of 25 random quadrant fungi locations in 2006, 16 of 24 in 2005, and 10 of 24 locations in 2004. The hypothesis that the SRS perimeter random fungi Cs-137 population had the same shape and location as the South Carolina background random Cs-137 population was not rejected for the combined 2004 through 2006 samples by application of the Wilcoxon Rank Sum, modified Quantile, median, Van der Waerden, and Savage Scores tests at the 1% significance level. The 5% significance level was not used since the compared random samples were collected over three years and a significant half-life reduction occurred among compared samples. Although analysis results correct for decay to the time of analysis, the fact that compared samples are collected at different times biases the statistics. However, power calculation tables (NFEC 1999) involving the median indicated that sufficient random sampling had not yet occurred to support the alternate hypothesis that the Cs-137 population within the 50-Mile SRS Perimeter is different in location than the South Carolina Background Cs-137 population. Atomic bomb test fallout tracking charts and data in combination with additional sampling statistics may eventually produce enough evidence to conclude whether the SRS 50-Mile perimeter Cs-137 population has a pattern of maximums that correspond with atomic bomb test fallout tracks. However, the presence of commercial nuclear power reactors in the South Carolina background may render the analysis inconclusive for facilities displaying similar weather tracks. The nonrandom fungi Cs-137 result (< MDA of 0.201 pCi/g) was within one standard deviation of the random Cs-137 results (0.898 pCi/g average ±1.019 standard deviation, (section 3.2.5). The highest Cs-137 detection (3.15 pCi/g) occurred in the Lake City West background quadrant.

DOE-SR did not collect fungi in 2006, but the ESOP 2006 maximum detection (3.15 pCi/g) and average above background (0.60 pCi/g) were far less than the 1983 (540 pCi/g) and 1984 (640

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pCi/g) DOE-SR maximum Cs-137 detections in fungi (DuPont 1984). Also, the maximum mixed fungi detection was similar to 1986 detections found in Vermont fungi (RADNET 2006). The ESOP average Cs-137 detection in mixed fungi for 2006 (0.60 pCi/g) was between the 2005 average (1.23 pCi/g) and the 2004 average (0.20 pCi/g).

It was not necessary to apply the probabilistic tests to other radionuclides of concern over a three-year basis, since there were no additional detections that would have changed last year's findings. However, all radionuclide concentration activities detected so far indicated that additional random sampling must continue before the power level (sampling number) can support any alternate hypothesis that the two populations are significantly different.

The radionuclide detections in general were possibly due to floodplain locations that may bioconcentrate radionuclides from up-gradient sources and direct aerial deposition. Historical nuclear atmospheric testing in the 1950s and 1960s and commercial nuclear power plants have also produced fission by-products (e.g., Cs-137 and Eu-155). Any detection of these radioisotopes cannot be assumed to be from SRS alone.

ESOP will collect more samples from similar flood plain locations in the future. Consumers of wild fungi should be aware that fungi are bioconcentrators of certain naturally occurring and artificial heavy metal radioisotopes that can be toxic and/or carcinogenic.

## CONCLUSIONS AND RECOMMENDATIONS

ESOP conducted independent vegetation monitoring in 2006 at 17 locations around the perimeter of the SRS, three locations 25 miles from the center of SRS, 12 locations selected at random from within a 50-mile radius of SRS, and 12 background locations greater than 50 miles from SRS. Tritium was detected in vegetation from all of the perimeter stations, two 25-mile, and two of the 50-mile stations; tritium was not detected at any background site. As in previous years, activity levels were higher in vegetation collected from the western side of SRS. ESOP data confirms the DOE-SR conclusion that elevated tritium levels at the site perimeter are due to atmospheric releases from SRS, but that tritium levels decrease with increasing distance from SRS facilities.

A comparison of ESOP and DOE-SR tritium data was performed. DOE-SR samples did not exhibit tritium activity at either colocation, while both ESOP samples did. DOE-SR detected tritium from two perimeter stations, while ESOP detected tritium at all perimeter locations. There are differences in analysis and sampling methods between the programs, but the abundance of tritium detections by ESOP in tree leaves versus DOE-SR grass needs further investigation. DOE-SR data are reported in pCi/g without denoting whether this activity relates to a gram of water or a gram of wet vegetation. ESOP recommends that DOE-SR report tritium activity in a more relevant manner, such as pCi/ml as in previous reports, to reflect the tritium activity in the water extracted from the sample.

The ESOP vegetation monitoring program was changed in 2005 to increase sampling near New Ellenton, S.C., where Cs-137 was detected in vegetation in previous years. The new station near New Ellenton exhibited the highest monthly Cs-137 activity in 2006. Samples from eight

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previously established permanent stations were analyzed for gamma-emitting radionuclides. At these locations in 2005, Cs-137 was detected at levels similar to 1998-2005, although there appears to be a downward trend in activity levels. It was unclear why these sites have higher cesium levels, as they were not located near SRS facilities, nor in areas known to be affected by past releases. A review of the deposition plume from the 1955 Teapot Hornet test (RAC 1999) showed the highest radiation levels from that test were not associated with the areas where ESOP finds the highest Cs-137 levels in vegetation. ESOP and DOE-SR results from the station on Patterson Mill Road exhibited similar Cs-137 activity levels, while results from another colocation at the Allendale Gate were quite different.

A quarterly sampling schedule will be continued in 2007. Sampling will again be conducted at randomly selected sites around South Carolina to determine background and near-SRS levels for tritium and gamma-emitting radionuclides.

Some fungal radionuclides detected in 2004 were not detected in 2005 (Eu-155, Ra-226, Ac-228) or 2006 (Eu-155 and Ac-228). Other single detections of Co-58 and Co-60 occurred in 2005 and were not detected in 2006. These cobalt detections may be from a background local source not related to SRS since they occurred in a single background sample. Radium-226 detections appear to be the dominant radionuclide of concern in 2006, since the average above background increased from 0.20 pCi/g in 2004 to 1.23 pCi/g in 2006. However, this may merely reflect the local soil types surveyed in a given year. The significance of any trending should be revealed by future statistical studies of several years of accumulated data. The radioisotope background contributions found in fungi from 2004 to 2006 may have originated from past atomic tests or commercial nuclear power companies, and cannot be distinguished from the SRS contributions within a 50-mile perimeter of a center-point within the SRS. However, the 2004 to 2006 Cs-137 concentration trend above background in mixed fungi indicated increasing concentrations as the comparison was narrowed to more relevant regions based on soil type. The 2004-2006 Cs-137 concentration trend increased as the comparison became more specific on a regional basis. Compare 1.19 pCi/g within the 50-mile SRS perimeter, and 1.26 pCi/g for the SC Coastal Plain Region alone to 1.30 pCi/g for the Upper Coastal Plain alone (which was most specific for the SRS area). Also, the comparison of fungi and soil Cs-137 activity concentrations found in the same quadrants indicated a consistently higher average Cs-137 activity concentration in fungi compared to soil. These results indicated that Cs-137 may become bioconcentrated in fungi, and represent increased exposure for the wild mushroom consumer, whether deer or human.

Continued sampling of fungi, random and nonrandom, should help to determine if the 10-mile exclusion zones for background collections around commercial reactors were sufficient.

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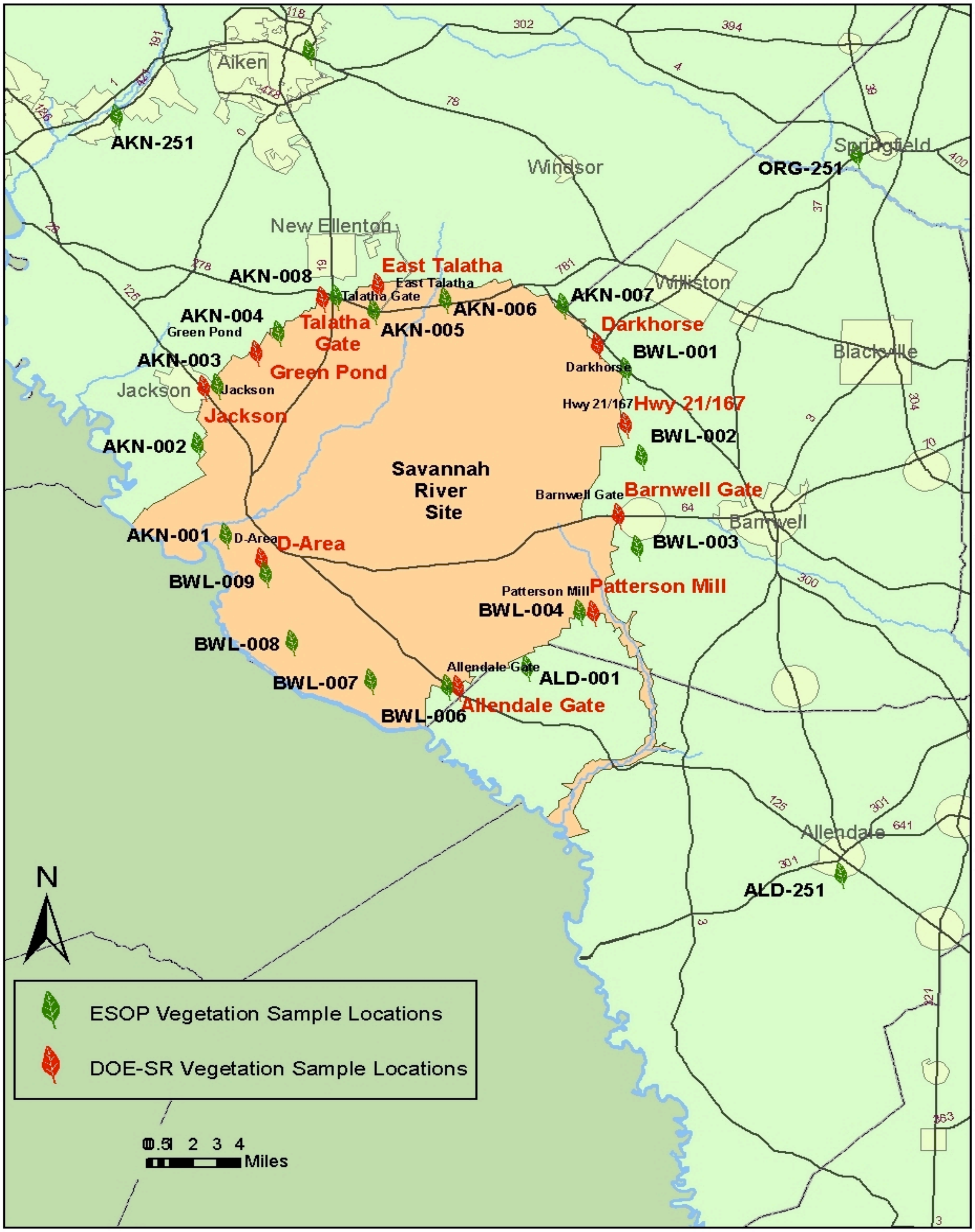
## 3.2.2
## Map 9. Radiological Monitoring of Terrestrial Vegetation Locations

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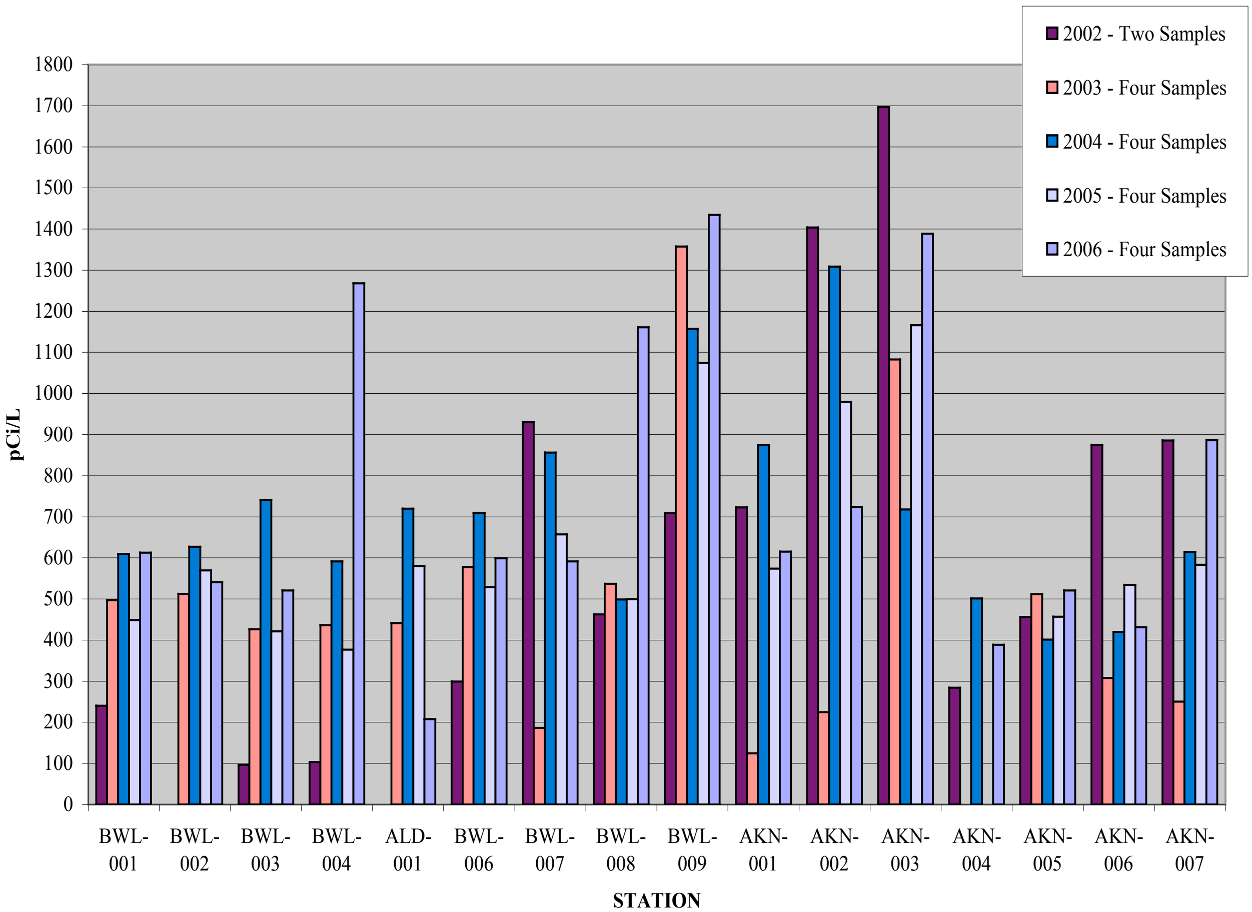
### 3.2.3 Tables and Figures
### Radiological Monitoring of Terrestrial Vegetation

Figure 1. Average Tritium in Vegetation at SRS Perimeter Locations, 2002-2006

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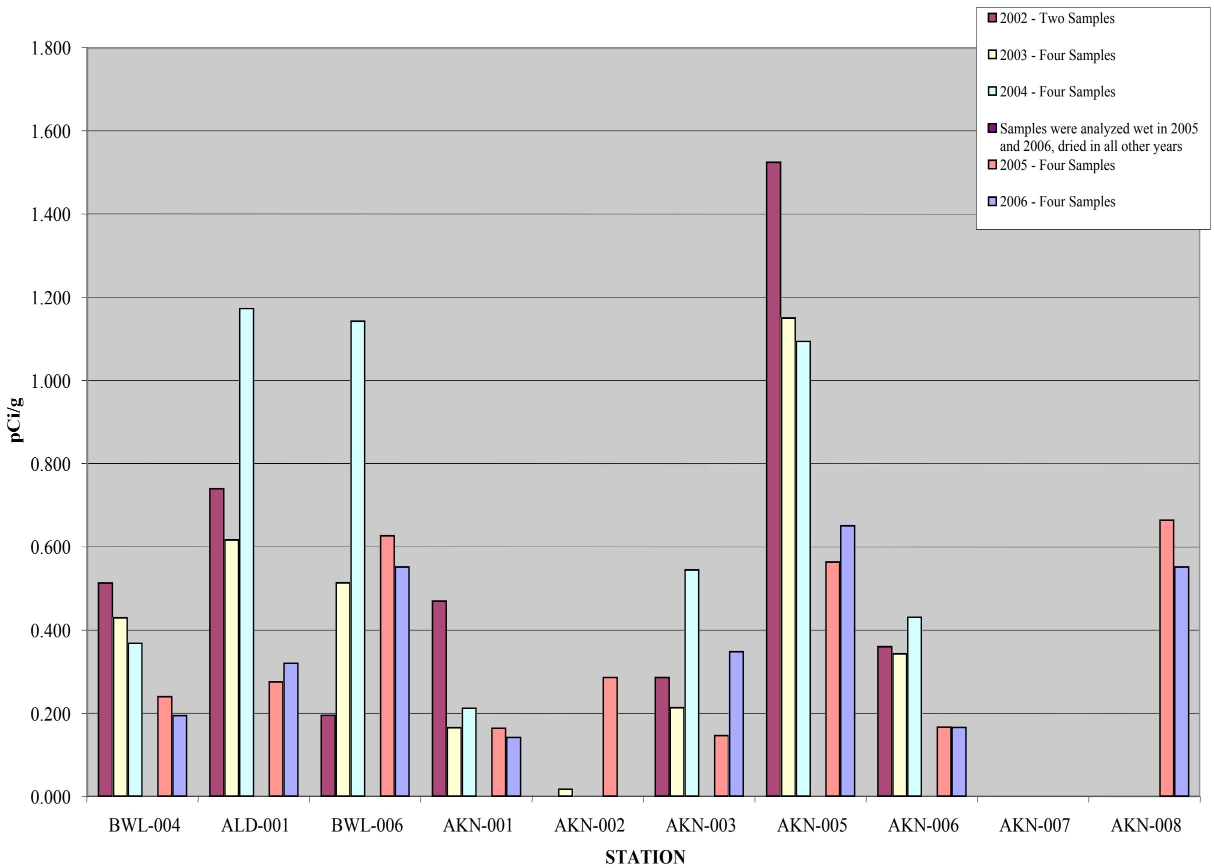
# Tables and Figures
## Radiological Monitoring of Terrestrial Vegetation

Figure 2. Average Cesium-137 in Vegetation at SRS Perimeter Locations, 2002-2006

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## Tables and Figures
## Radiological Monitoring of Terrestrial Vegetation

Table 1. Tritium analysis results from ESOP and DOE-SR sampling locations, 2006.

| DOE-SR DATA (WSRC 2007) | | Tritium | | ESOP DATA | | Tritium |
|---|---|---|---|---|---|---|
| Station | Date | pCi/g | pCi /L[a] | Station | Date | pCi/L |
| D-Area | 5/4/06 | <MDC | | BWL-009 [b] | 5/12/06 | 917 |
| Jackson | 5/3/06 | <MDC | | AKN-003 [b] | 5/15/06 | 1858 |
| Green Pond | 5/3/06 | <MDC | | AKN-004 [b] | 5/9/06 | 539 |
| Talatha Gate | 5/23/06 | 0.108 | 514 | AKN-005 [b] | 5/17/06 | 218 |
| East Talatha | 5/3/06 | <MDC | | AKN-006 [b] | 5/17/06 | 447 |
| Darkhorse | 5/3/06 | <MDC | | BWL-001 [b] | 5/9/06 | 735 |
| Highway 21/167 | 5/4/06 | <MDC | | BWL-002 [b] | 5/9/06 | 541 |
| Barnwell Gate | 5/4/06 | 0.144 | 686 | | | |
| | | | | BWL-003 | 5/9/06 | 333 |
| Patterson Mill Road [c] | 5/4/06 | <MDC | | BWL-004 [c] | 5/15/06 | 976 |
| | | | | ALD-001 | 5/15/06 | <187 |
| Allendale Gate [c] | 5/4/06 | <MDC | | BWL-006 [c] | 5/15/06 | 601 |
| | | **Average** | 600 | | **Average** | 717 |
| | | **Std Dev** | 122 | | **Std Dev** | 466 |
| | | **Median** | 600 | | **Median** | 571 |

[a] Converted [b] Comparable ESOP location [c] Colocation

<MDC denotes less than the Minimum Detectable Concentration (MDC not reported)

< - denotes less than reported Lower Limit of Detection

Std Dev – Standard Deviation

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## Tables and Figures
## Radiological Monitoring of Terrestrial Vegetation

Table 2. Cesium-137 analysis results from ESOP and DOE-SR sampling locations, 2006.

| DOE-SR DATA (WSRC 2007) | | Cs-137 | | ESOP DATA | | Cs-137 | |
|---|---|---|---|---|---|---|---|
| Location | Date | pCi/g **(dry)** | +/- 1 sig | Station | Date | pCi/g **(fresh)** | +/- 2 sig |
| D-Area | 5/4/06 | 0.166 | 0.039 | AKN-001[a] | 5/15/06 | 0.206 | 0.036 |
| Jackson | 5/3/06 | <MDC | | AKN-003[a] | 5/15/06 | 0.150 | 0.027 |
| Green Pond | 5/3/06 | <MDC | | AKN-003[a] | 5/15/06 | 0.150 | 0.027 |
| Talatha Gate | 5/23/06 | 0.132 | 0.034 | AKN-008[a] | 5/17/06 | 0.619 | 0.074 |
| East Talatha | 5/3/06 | 0.297 | 0.056 | AKN-005[a] | 5/17/06 | 0.712 | 0.084 |
| Darkhorse | 5/3/06 | 0.132 | 0.034 | AKN-006[a] | 5/17/06 | 0.169 | 0.028 |
| Barnwell Gate | 5/4/06 | 0.212 | 0.032 | BWL-004[a] | 5/15/06 | 0.193 | 0.034 |
| Patterson Mill Road[b] | 5/4/06 | 0.066 | 0.019 | BWL-004[b] | 5/15/06 | 0.193 | 0.034 |
| | | | | ALD-001[a] | 5/15/06 | 0.267 | 0.042 |
| Allendale Gate[b] | 5/4/06 | 0.112 | 0.030 | BWL-006[b] | 5/15/06 | 0.695 | 0.081 |
| | **Average** | 0.158 | | | **Average** | 0.335 | |
| | **Std Dev** | 0.083 | | | **Std Dev** | 0.238 | |
| | **Median** | 0.132 | | | **Median** | 0.199 | |

Notes:
[a] Closest ESOP station with gamma collections
[b] Colocation
<MDC denotes less than the Minimum Detectable Concentration (MDC not reported)
Std Dev – Standard Deviation

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## Tables and Figures
## Radiological Monitoring of Terrestrial Vegetation

Table 3. Fungi Average Activity > SC Background by Geographic Soil Regions, 2004-2006.

| Radioisotope (pCi/g) | All South Carolina | Coastal Plain - South Carolina |
|---|---|---|
| **Cs-137** | 0.59 | 0.66 |
| **K-40** | 3.35 | 3.97 |
| **Pb-212** | 0.26 | 0.26 |
| **Pb-214** | 0.35 | 0.39 |
| **Ra-226** | 3.24 | 3.32 |

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### 3.2.4 Data
### Terrestrial Vegetation Radiological Monitoring Data



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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | AKN-001 - TNX Area | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/15/06 | 08/03/06 | 11/27/06 |
| Radionuclides | Tritium (pCi/L) | 509 | 591 | 718 | 642 |
| | +/- 2 sigma | 100 | 99 | 113 | 107 |
| | LLD | 187 | 174 | 201 | 191 |
| | Be-7 (pCi/g) | 2.817 | 1.131 | 1.04 | 1.333 |
| | +/- 2 sigma | 0.733 | 0.306 | 0.381 | 0.361 |
| | MDA | 0.566 | 0.267 | 0.323 | 0.225 |
| | K-40 (pCi/g) | 1.950 | 2.271 | 2.853 | 2.369 |
| | +/- 2 sigma | 0.459 | 0.414 | 0.427 | 0.376 |
| | MDA | 0.224 | 0.176 | 0.178 | 0.145 |
| | Cs-137 (pCi/g) | 0.121 | 0.206 | 0.165 | 0.086 |
| | +/- 2 sigma | 0.033 | 0.036 | 0.027 | 0.029 |
| | MDA | 0.031 | 0.023 | 0.023 | 0.022 |

| Station: | AKN-002 - Crackerneck gate | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/15/06 | 08/03/06 | 11/27/06 |
| Radionuclides | Tritium (pCi/L) | 857 | 618 | 810 | 612 |
| | +/- 2 sigma | 112 | 100 | 116 | 106 |
| | LLD | 187 | 174 | 201 | 191 |
| | Be-7 (pCi/g) | 5.229 | 1.29 | 1.664 | 1.575 |
| | +/- 2 sigma | 0.781 | 0.268 | 0.438 | 0.354 |
| | MDA | 0.452 | 0.251 | 0.346 | 0.231 |
| | K-40 (pCi/g) | 1.954 | 3.200 | 2.760 | 1.919 |
| | +/- 2 sigma | 0.376 | 0.422 | 0.393 | 0.396 |
| | MDA | 0.159 | 0.183 | 0.192 | 0.181 |
| | Cs-137 (pCi/g) | <0.026 | <0.025 | <0.025 | < 0.022 |
| | +/- 2 sigma | | | | |
| | MDA | | | | |

| Station: | AKN-003 - SRS Rd. 1 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/15/06 | 08/03/06 | 11/27/06 |
| Radionuclides | Tritium (pCi/L) | 560 | 1858 | <201 | 1749 |
| | +/- 2 sigma | 102 | 140 | | 141 |
| | LLD | 187 | 174 | | 191 |
| | Be-7 (pCi/g) | 3.264 | 0.742 | <0.513 | 1.804 |
| | +/- 2 sigma | 0.784 | 0.262 | | 0.295 |
| | MDA | 0.528 | 0.260 | | 0.205 |
| | K-40 (pCi/g) | 1.867 | 2.358 | 3.282 | 1.607 |
| | +/- 2 sigma | 0.400 | 0.431 | 0.054 | 0.358 |
| | MDA | 0.178 | 0.176 | 0.255 | 0.171 |
| | Cs-137 (pCi/g) | 0.913 | 0.150 | 0.211 | 0.126 |
| | +/- 2 sigma | 0.124 | 0.027 | 0.046 | 0.030 |
| | MDA | 0.025 | 0.023 | 0.032 | 0.024 |

| Station: | AKN-004 - SRS Rd. 1 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/09/06 | 08/01/06 | 11/24/06 |
| Radionuclides | Tritium (pCi/L) | <189 | 539 | 436 | 191 |
| | +/- 2 sigma | | 97 | 101 | 89 |
| | LLD | | 174 | 198 | 191 |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | AKN-005 - U.S. Hwy. 278 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/17/06 | 08/02/06 | 11/27/06 |
| Radionuclides | Tritium (pCi/L) | 1066 | 218 | 551 | 247 |
| | +/- 2 sigma | 120 | 88 | 106 | 91 |
| | LLD | 189 | 187 | 198 | 191 |
| | Be-7 (pCi/g) | 3.992 | 0.7074 | 1.206 | 2.305 |
| | +/- 2 sigma | 0.678 | 0.248 | 0.367 | 0.465 |
| | MDA | 0.435 | 0.296 | 0.328 | 0.277 |
| | K-40 (pCi/g) | 2.144 | 2.827 | 1.673 | 1.804 |
| | +/- 2 sigma | 0.405 | 0.416 | 0.354 | 0.400 |
| | MDA | 0.165 | 0.180 | 0.354 | 0.194 |
| | Cs-137 (pCi/g) | 0.461 | 0.712 | 0.754 | 0.685 |
| | +/- 2 sigma | 0.070 | 0.084 | 0.076 | 0.083 |
| | MDA | 0.026 | 0.024 | 0.022 | 0.024 |

| Station: | AKN-006 - U.S. Hwy. 278 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/17/06 | 08/02/06 | 11/03/06 |
| Radionuclides | Tritium (pCi/L) | 408 | 447 | 599 | 271 |
| | +/- 2 sigma | 97 | 97 | 107 | 90 |
| | LLD | 189 | 187 | 198 | 186 |
| | Be-7 (pCi/g) | 2.371 | 1.098 | 2.187 | 1.566 |
| | +/- 2 sigma | 0.556 | 0.315 | 0.388 | 0.397 |
| | MDA | 0.428 | 0.272 | 0.326 | 0.254 |
| | K-40 (pCi/g) | 1.666 | 2.348 | 2.089 | 1.690 |
| | +/- 2 sigma | 0.403 | 0.373 | 0.369 | 0.362 |
| | MDA | 0.174 | 0.157 | 0.158 | 0.185 |
| | Cs-137 (pCi/g) | 0.135 | 0.169 | 0.284 | 0.085 |
| | +/- 2 sigma | 0.027 | 0.028 | 0.041 | 0.028 |
| | MDA | 0.022 | 0.022 | 0.020 | 0.021 |

| Station: | AKN-007 - Aiken Co. Rd. 74 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/09/06 | 08/02/06 | 11/08/06 |
| Radionuclides | Tritium (pCi/L) | 2013 | 397 | 249 | <186 |
| | +/- 2 sigma | 146 | 91 | 94 | |
| | LLD | 189 | 174 | 198 | |

| Station: | AKN-008 - U.S. Hwy. 278 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 05/17/06 | 08/02/06 | 11/27/06 |
| Radionuclides | Be-7 (pCi/g) | 3.229 | 0.7477 | 0.9639 | 3.097 |
| | +/- 2 sigma | 0.616 | 0.319 | 0.332 | 0.513 |
| | MDA | 0.462 | 0.293 | 0.351 | 0.244 |
| | K-40 (pCi/g) | 2.352 | 3.099 | 2.133 | 2.253 |
| | +/- 2 sigma | 0.459 | 0.430 | 0.3822 | 0.451 |
| | MDA | 0.184 | 0.175 | 0.3822 | 0.207 |
| | Cs-137 (pCi/g) | 0.408 | 0.619 | 0.923 | 0.476 |
| | +/- 2 sigma | 0.064 | 0.074 | 0.092 | 0.064 |
| | MDA | 0.025 | 0.024 | 0.023 | 0.023 |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | BWL-001 - U.S. Hwy. 278 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/09/06 | 08/02/06 | 11/24/06 |
| Radionuclides | Tritium (pCi/L) | 1012 | 735 | 254 | 450 |
| | +/- 2 sigma | 118 | 105 | 94 | 99 |
| | LLD | 189 | 174 | 198 | 191 |

| Station: | BWL-002 - Barnwell Co. Rd. 21 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/09/06 | 08/02/06 | 11/24/06 |
| Radionuclides | Tritium (pCi/L) | 523 | 541 | 655 | 444 |
| | +/- 2 sigma | 101 | 97 | 109 | 99 |
| | LLD | 189 | 174 | 198 | 191 |

| Station: | BWL-003 - Barnwell Co. Rd. 54 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/09/06 | 08/02/06 | 11/06/06 |
| Radionuclides | Tritium (pCi/L) | 377 | 333 | 852 | <186 |
| | +/- 2 sigma | 95 | 89 | 116 | |
| | LLD | 189 | 174 | 198 | |

| Station: | BWL-004 - Air Station 614-62G | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/08/06 | 05/15/06 | 08/03/06 | 11/03/06 |
| Radionuclides | Tritium (pCi/L) | 1412 | 976 | 1416 | <186 |
| | +/- 2 sigma | 130 | 116 | 134 | |
| | LLD | 187 | 187 | 201 | |
| | Be-7 (pCi/g) | 6.299 | 0.7234 | 1.767 | 2.262 |
| | +/- 2 sigma | 0.811 | 0.240 | 0.331 | 0.406 |
| | MDA | 0.470 | 0.257 | 0.308 | 0.290 |
| | K-40 (pCi/g) | 1.533 | 2.677 | 1.906 | 1.670 |
| | +/- 2 sigma | 0.392 | 0.390 | 0.362 | 0.412 |
| | MDA | 0.197 | 0.179 | 0.191 | 0.205 |
| | Cs-137 (pCi/g) | 0.244 | 0.193 | 0.158 | 0.193 |
| | +/- 2 sigma | 0.047 | 0.034 | 0.032 | 0.034 |
| | MDA | 0.026 | 0.021 | 0.022 | 0.026 |

| Station: | ALD-001 - Allendale Co. Rd. 12 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/08/06 | 05/15/06 | 08/03/06 | 11/03/06 |
| Radionuclides | Tritium (pCi/L) | 208 | <187 | <201 | <186 |
| | +/- 2 sigma | 88 | | | |
| | LLD | 187 | | | |
| | Be-7 (pCi/g) | 2.971 | 0.5835 | 1.132 | 1.092 |
| | +/- 2 sigma | 0.653 | 0.252 | 0.339 | 0.358 |
| | MDA | 0.453 | 0.281 | 0.340 | 0.322 |
| | K-40 (pCi/g) | 2.295 | 2.950 | 2.685 | 1.900 |
| | +/- 2 sigma | 0.448 | 0.422 | 0.417 | 0.399 |
| | MDA | 0.213 | 0.182 | 0.176 | 0.175 |
| | Cs-137 (pCi/g) | 0.290 | 0.267 | 0.433 | 0.300 |
| | +/- 2 sigma | 0.049 | 0.042 | 0.050 | 0.047 |
| | MDA | 0.026 | 0.022 | 0.024 | 0.022 |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | BWL-006 - Allendale Gate | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/08/06 | 05/15/06 | 08/03/06 | 11/03/06 |
| Radionuclides | Tritium (pCi/L) | 281 | 601 | 780 | 735 |
| | +/- 2 sigma | 91 | 99 | 115 | 114 |
| | LLD | 187 | 174 | 201 | 186 |
| | Be-7 (pCi/g) | 1.229 | 0.5533 | <0.390 | 0.7063 |
| | +/- 2 sigma | 0.441 | 0.250 | | 0.335 |
| | MDA | 0.470 | 0.265 | | 0.305 |
| | K-40 (pCi/g) | 1.577 | 1.872 | 3.046 | 1.905 |
| | +/- 2 sigma | 0.380 | 0.384 | 0.405 | 0.385 |
| | MDA | 0.197 | 0.178 | 0.180 | 0.206 |
| | Cs-137 (pCi/g) | 0.362 | 0.695 | 0.744 | 0.413 |
| | +/- 2 sigma | 0.058 | 0.081 | 0.076 | 0.061 |
| | MDA | 0.025 | 0.022 | 0.021 | 0.024 |

| Station: | BWL-007 - SRS Rd. A-17 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/12/06 | 08/01/06 | 11/06/06 |
| Radionuclides | Tritium (pCi/L) | 490 | 530 | 907 | 440 |
| | +/- 2 sigma | 100 | 97 | 118 | 97 |
| | LLD | 189 | 174 | 198 | 186 |

| Station: | BWL-008 - SRS Rd. A-13 | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/08/06 | 05/12/06 | 08/01/06 | 11/06/06 |
| Radionuclides | Tritium (pCi/L) | 1690 | 795 | 1415 | 744 |
| | +/- 2 sigma | 138 | 107 | 133 | 109 |
| | LLD | 187 | 174 | 198 | 186 |

| Station: | BWL-009 - D-Area | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/12/06 | 08/01/06 | 11/06/06 |
| Radionuclides | Tritium (pCi/L) | 2429 | 917 | 1512 | 881 |
| | +/- 2 sigma | 157 | 111 | 137 | 113 |
| | LLD | 189 | 174 | 198 | 186 |

| Station: | AKN-251 - Langley, SC | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/09/06 | 08/01/06 | 11/08/06 |
| Radionuclides | Tritium (pCi/L) | 245 | 235 | 284 | <186 |
| | +/- 2 sigma | 90 | 84 | 95 | |
| | LLD | 189.000 | 174 | 198 | |

| Station: | ALD-251 - Allendale, SC | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/12/06 | 08/01/06 | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | <189 | 181 | 279 | <186 |
| | +/- 2 sigma | | 82 | 95 | |
| | LLD | | 174 | 198 | |

| Station: | ORG-251 - Springfield, SC | | | | |
|---|---|---|---|---|---|
| Sample Date: | | 02/01/06 | 05/09/06 | 08/01/06 | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | <189 | <174 | <198 | <186 |
| | +/- 2 sigma | | | | |
| | LLD | | | | |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | B26 - Jasper Co., SC | |
|---|---|---|
| Sample Date: | | 02/10/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 3.846 |
| | +/- 2 sigma | 0.6129 |
| | MDA | 0.4674 |
| | K-40 (pCi/g) | 1.711 |
| | +/- 2 sigma | 0.438 |
| | MDA | 0.180 |
| | Cs-137 (pCi/g) | <0.025 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B29 - Colleton Co., SC | |
|---|---|---|
| Sample Date: | | 02/10/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 3.078 |
| | +/- 2 sigma | 0.659 |
| | MDA | 0.395 |
| | K-40 (pCi/g) | 1.192 |
| | +/- 2 sigma | 0.346 |
| | MDA | 0.198 |
| | Cs-137 (pCi/g) | <0.027 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B31 - Jasper Co., SC | |
|---|---|---|
| Sample Date: | | 02/10/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.746 |
| | +/- 2 sigma | 0.498 |
| | MDA | 0.426 |
| | K-40 (pCi/g) | 1.511 |
| | +/- 2 sigma | 0.429 |
| | MDA | 0.209 |
| | Cs-137 (pCi/g) | <0.026 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E29 - Allendale Co., SC | |
|---|---|---|
| Sample Date: | | 02/16/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 4.290 |
| | +/- 2 sigma | 0.632 |
| | MDA | 0.372 |
| | K-40 (pCi/g) | 1.194 |
| | +/- 2 sigma | 0.300 |
| | MDA | 0.128 |
| | Cs-137 (pCi/g) | <0.025 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E37 - Allendale Co., SC | |
|---|---|---|
| Sample Date: | | 02/16/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.852 |
| | +/- 2 sigma | 0.463 |
| | MDA | 0.401 |
| | K-40 (pCi/g) | 2.117 |
| | +/- 2 sigma | 0.379 |
| | MDA | 0.133 |
| | Cs-137 (pCi/g) | <0.021 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E38 - Allendale Co., SC | |
|---|---|---|
| Sample Date: | | 02/16/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.852 |
| | +/- 2 sigma | 0.4631 |
| | MDA | 0.4014 |
| | K-40 (pCi/g) | 1.947 |
| | +/- 2 sigma | 0.389 |
| | MDA | 0.174 |
| | Cs-137 (pCi/g) | <0.026 |
| | +/- 2 sigma | |
| | MDA | |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | E31 - Aiken Co., SC | |
|---|---|---|
| Sample Date: | | 05/17/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 0.874 |
| | +/- 2 sigma | 0.289 |
| | MDA | 0.285 |
| | K-40 (pCi/g) | 4.101 |
| | +/- 2 sigma | 0.477 |
| | MDA | 0.165 |
| | Cs-137 (pCi/g) | <0.026 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B33 - Greenwood Co., SC | |
|---|---|---|
| Sample Date: | | 05/18/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | <0.296 |
| | +/- 2 sigma | |
| | MDA | |
| | K-40 (pCi/g) | 3.101 |
| | +/- 2 sigma | 0.456 |
| | MDA | 0.190 |
| | Cs-137 (pCi/g) | 0.087 |
| | +/- 2 sigma | 0.029 |
| | MDA | 0.023 |

| Station: | E34 - Lexington Co., SC | |
|---|---|---|
| Sample Date: | | 05/17/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 0.807 |
| | +/- 2 sigma | 0.282 |
| | MDA | 0.242 |
| | K-40 (pCi/g) | 2.587 |
| | +/- 2 sigma | 0.358 |
| | MDA | 0.156 |
| | Cs-137 (pCi/g) | <0.020 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B34 - Greenwood Co., SC | |
|---|---|---|
| Sample Date: | | 05/18/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 0.445 |
| | +/- 2 sigma | 0.204 |
| | MDA | 0.282 |
| | K-40 (pCi/g) | 3.325 |
| | +/- 2 sigma | 0.396 |
| | MDA | 0.161 |
| | Cs-137 (pCi/g) | <0.023 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E35 - Lexington Co., SC | |
|---|---|---|
| Sample Date: | | 05/17/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 0.755 |
| | +/- 2 sigma | 0.232 |
| | MDA | 0.251 |
| | K-40 (pCi/g) | 4.505 |
| | +/- 2 sigma | 0.478 |
| | MDA | 0.159 |
| | Cs-137 (pCi/g) | <0.021 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B36 - Abbeville Co., SC | |
|---|---|---|
| Sample Date: | | 05/18/06 |
| Radionuclides | Tritium (pCi/L) | <187 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | <0.312 |
| | +/- 2 sigma | |
| | MDA | |
| | K-40 (pCi/g) | 2.972 |
| | +/- 2 sigma | 0.444 |
| | MDA | 0.191 |
| | Cs-137 (pCi/g) | <0.025 |
| | +/- 2 sigma | |
| | MDA | |

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## Terrestrial Vegetation Radiological Monitoring
## Vegetation Analysis Results

| Station: | E27 - Edgefield Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 2.481 |
| | +/- 2 sigma | 0.309 |
| | MDA | 0.256 |
| | K-40 (pCi/g) | 2.850 |
| | +/- 2 sigma | 0.402 |
| | MDA | 0.173 |
| | Cs-137 (pCi/g) | <0.025 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B27 - McCormick Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.995 |
| | +/- 2 sigma | 0.305 |
| | MDA | 0.246 |
| | K-40 (pCi/g) | 2.624 |
| | +/- 2 sigma | 0.436 |
| | MDA | 0.171 |
| | Cs-137 (pCi/g) | <0.021 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E30 - Aiken Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | <0.239 |
| | +/- 2 sigma | |
| | MDA | |
| | K-40 (pCi/g) | 4.867 |
| | +/- 2 sigma | 0.486 |
| | MDA | 0.166 |
| | Cs-137 (pCi/g) | <0.022 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B32 - Saluda Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.544 |
| | +/- 2 sigma | 0.281 |
| | MDA | 0.229 |
| | K-40 (pCi/g) | 3.531 |
| | +/- 2 sigma | 0.429 |
| | MDA | 0.167 |
| | Cs-137 (pCi/g) | 0.046 |
| | +/- 2 sigma | 0.022 |
| | MDA | 0.020 |

| Station: | E32 - Edgefield Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.174 |
| | +/- 2 sigma | 0.252 |
| | MDA | 0.254 |
| | K-40 (pCi/g) | 5.219 |
| | +/- 2 sigma | 0.521 |
| | MDA | 0.164 |
| | Cs-137 (pCi/g) | <0.022 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B35 - McCormick Co., SC | |
|---|---|---|
| Sample Date: | | 08/29/06 |
| Radionuclides | Tritium (pCi/L) | <201 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.667 |
| | +/- 2 sigma | 0.335 |
| | MDA | 0.256 |
| | K-40 (pCi/g) | 3.230 |
| | +/- 2 sigma | 0.414 |
| | MDA | 0.018 |
| | Cs-137 (pCi/g) | <0.024 |
| | +/- 2 sigma | |
| | MDA | |

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# Terrestrial Vegetation Radiological Monitoring
# Vegetation Analysis Results

| Station: | E28 - Orangeburg Co., SC | |
|---|---|---|
| Sample Date: | | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | 207 |
| | +/- 2 sigma | 87 |
| | LLD | 186 |
| | Be-7 (pCi/g) | 1.444 |
| | +/- 2 sigma | 0.415 |
| | MDA | 0.281 |
| | K-40 (pCi/g) | 2.818 |
| | +/- 2 sigma | 0.424 |
| | MDA | 0.183 |
| | Cs-137 (pCi/g) | 0.042 |
| | +/- 2 sigma | 0.017 |
| | MDA | 0.024 |

| Station: | B25 - Orangeburg Co., SC | |
|---|---|---|
| Sample Date: | | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | <186 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 2.131 |
| | +/- 2 sigma | 0.394 |
| | MDA | 0.285 |
| | K-40 (pCi/g) | 1.030 |
| | +/- 2 sigma | 0.296 |
| | MDA | 0.135 |
| | Cs-137 (pCi/g) | < 0.025 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E33 - Barnwell Co., SC | |
|---|---|---|
| Sample Date: | | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | 697 |
| | +/- 2 sigma | 107 |
| | LLD | 186 |
| | Be-7 (pCi/g) | 1.105 |
| | +/- 2 sigma | 0.306 |
| | MDA | 0.242 |
| | K-40 (pCi/g) | 1.209 |
| | +/- 2 sigma | 0.258 |
| | MDA | 0.165 |
| | Cs-137 (pCi/g) | < 0.020 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B28 - Williamsburg Co., SC | |
|---|---|---|
| Sample Date: | | 11/28/06 |
| Radionuclides | Tritium (pCi/L) | <191 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 2.169 |
| | +/- 2 sigma | 0.346 |
| | MDA | 0.254 |
| | K-40 (pCi/g) | 2.419 |
| | +/- 2 sigma | 0.435 |
| | MDA | 0.188 |
| | Cs-137 (pCi/g) | < 0.022 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | E36 - Orangeburg Co., SC | |
|---|---|---|
| Sample Date: | | 11/09/06 |
| Radionuclides | Tritium (pCi/L) | <186 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 1.468 |
| | +/- 2 sigma | 0.319 |
| | MDA | 0.277 |
| | K-40 (pCi/g) | 3.370 |
| | +/- 2 sigma | 0.535 |
| | MDA | 0.223 |
| | Cs-137 (pCi/g) | < 0.023 |
| | +/- 2 sigma | |
| | MDA | |

| Station: | B30 - Dillon Co., SC | |
|---|---|---|
| Sample Date: | | 11/28/06 |
| Radionuclides | Tritium (pCi/L) | <191 |
| | +/- 2 sigma | |
| | LLD | |
| | Be-7 (pCi/g) | 3.953 |
| | +/- 2 sigma | 0.490 |
| | MDA | 0.248 |
| | K-40 (pCi/g) | 1.437 |
| | +/- 2 sigma | 0.299 |
| | MDA | 0.200 |
| | Cs-137 (pCi/g) | < 0.025 |
| | +/- 2 sigma | |
| | MDA | |

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## Terrestrial Vegetation Radiological Monitoring
## Fungi Analysis Results Random Background Samples

| Isotope | B25 | B26 | B27 | B28 | B29 | B30 | B31 | B32 | B33 | B34 | B35 | B36 | B37 | B41 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Be-7** | **<MDA** | **<MDA** | **5.47** | **<MDA** | **<MDA** | **1.38** | **<MDA** | **2.60** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 1.04 | 2.12 | 1.27 | 1.01 | 2.15 | 0.84 | 1.96 | 0.74 | 6.84 | 1.72 | 1.27 | 5.21 | 3.44 | 1.22 |
| **Na-22** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.09 | 0.08 | 0.08 | 0.06 | 0.10 | 0.11 | 0.07 | 0.05 | 0.07 | 0.06 | 0.08 | 0.06 | 0.04 | 0.07 |
| **K-40** | **10.53** | **3.79** | **1.96** | **6.23** | **4.31** | **15.26** | **3.83** | **1.89** | **4.60** | **<MDA** | **11.24** | **2.98** | **6.05** | **3.97** |
| MDA | 0.82 | 0.62 | 0.70 | 0.49 | 0.58 | 0.85 | 0.57 | 0.33 | 0.55 | 0.50 | 0.46 | 0.41 | 0.28 | 0.55 |
| **Mn-54** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.10 | 0.09 | 0.08 | 0.06 | 0.09 | 0.09 | 0.09 | 0.05 | 0.10 | 0.07 | 0.07 | 0.07 | 0.05 | 0.07 |
| **Co-58** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.10 | 0.16 | 0.12 | 0.08 | 0.19 | 0.10 | 0.15 | 0.08 | 0.36 | 0.13 | 0.11 | 0.29 | 0.20 | 0.12 |
| **Co-60** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.10 | 0.07 | 0.08 | 0.05 | 0.09 | 0.10 | 0.07 | 0.04 | 0.07 | 0.06 | 0.07 | 0.05 | 0.03 | 0.06 |
| **Zn-65** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.19 | 0.20 | 0.20 | 0.14 | 0.22 | 0.20 | 0.20 | 0.12 | 0.23 | 0.17 | 0.18 | 0.18 | 0.12 | 0.19 |
| **Y-88** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.08 | 0.10 | 0.11 | 0.07 | 0.13 | 0.10 | 0.10 | 0.05 | 0.16 | 0.07 | 0.07 | 0.14 | 0.09 | 0.08 |
| **Zr-95** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.17 | 0.33 | 0.23 | 0.15 | 0.37 | 0.20 | 0.31 | 0.15 | 0.82 | 0.28 | 0.23 | 0.65 | 0.42 | 0.26 |
| **Ru-103** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.14 | 0.34 | 0.20 | 0.14 | 0.37 | 0.10 | 0.34 | 0.12 | 1.75 | 0.29 | 0.18 | 1.41 | 0.95 | 0.21 |
| **Sb-125** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.27 | 0.26 | 0.19 | 0.21 | 0.22 | 0.24 | 0.26 | 0.11 | 0.24 | 0.21 | 0.17 | 0.19 | 0.12 | 0.17 |
| **I-131** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.95 | >8hle | 10.50 | 2.47 | >8hle | 0.29 | >8hle | >8hle | >8hle | >8hle | >8hle | >8hle | >8hle | >8hle |
| **Cs-134** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.08 | 0.08 | 0.07 | 0.06 | 0.08 | 0.09 | 0.08 | 0.04 | 0.08 | 0.07 | 0.06 | 0.06 | 0.04 | 0.06 |
| **Cs-137** | **2.36** | **0.68** | **<MDA** | **3.15** | **0.21** | **0.40** | **0.87** | **<MDA** | **0.19** | **0.27** | **0.46** | **0.40** | **<MDA** | **0.20** |
| MDA | 0.09 | 0.08 | 0.07 | 0.07 | 0.07 | 0.10 | 0.08 | 0.04 | 0.07 | 0.07 | 0.06 | 0.06 | 0.04 | 0.06 |
| **Ce-144** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.41 | 0.79 | 0.44 | 0.58 | 0.55 | 0.41 | 0.80 | 0.25 | 0.93 | 0.68 | 0.37 | 0.71 | 0.48 | 0.38 |
| **Eu-152** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.15 | 0.25 | 0.13 | 0.21 | 0.16 | 0.14 | 0.25 | 0.08 | 0.23 | 0.22 | 0.11 | 0.18 | 0.12 | 0.12 |
| **Eu-154** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.11 | 0.18 | 0.09 | 0.14 | 0.11 | 0.10 | 0.17 | 0.06 | 0.16 | 0.15 | 0.08 | 0.13 | 0.08 | 0.09 |
| **Eu-155** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.17 | 0.30 | 0.17 | 0.24 | 0.19 | 0.18 | 0.30 | 0.10 | 0.27 | 0.26 | 0.14 | 0.22 | 0.14 | 0.15 |
| **Pb-212** | **<MDA** | **<MDA** | **0.16** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.10 | 0.15 | 0.07 | 0.13 | 0.10 | 0.10 | 0.15 | 0.05 | 0.13 | 0.13 | 0.08 | 0.11 | 0.07 | 0.08 |
| **Pb-214** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **0.44** |
| MDA | 0.19 | 0.20 | 0.16 | 0.18 | 0.19 | 0.18 | 0.20 | 0.09 | 0.18 | 0.18 | 0.13 | 0.15 | 0.10 | 0.01 |
| **Ra-226** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 1.75 | 2.25 | 1.34 | 1.93 | 1.74 | 1.82 | 2.20 | 0.71 | 1.98 | 1.95 | 1.21 | 1.54 | 0.93 | 1.38 |
| **Ac-228** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.39 | 0.36 | 0.38 | 0.31 | 0.38 | 0.38 | 0.36 | 0.20 | 0.33 | 0.30 | 0.33 | 0.27 | 0.18 | 0.35 |
| **Th-234** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 1.02 | 1.74 | 0.92 | 1.47 | 0.99 | 1.02 | 1.72 | 0.51 | 1.52 | 1.52 | 0.75 | 1.18 | 0.80 | 0.79 |
| **Am-241** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** | **<MDA** |
| MDA | 0.13 | 0.50 | 0.11 | 0.44 | 0.12 | 0.13 | 0.50 | 0.06 | 0.43 | 0.44 | 0.10 | 0.37 | 0.24 | 0.10 |

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## Terrestrial Vegetation Radiological Monitoring
## Fungi Analysis Results Random Perimeter Samples

| Isotope | E27 | E28 | E29 | E30 | E31 | E32 | E33 | E34 | E35 | E36 | E37 | E38 | E39 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Be-7** | **2.38** | <MDA | **1.78** | <MDA | <MDA | <MDA | <MDA | <MDA | **3.26** | <MDA | **1.55** | <MDA | <MDA |
| MDA | 0.70 | 2.08 | 0.83 | 4.64 | 4.56 | 0.75 | 2.48 | 1.33 | 0.74 | 4.92 | 0.55 | 1.58 | 1.46 |
| **Na-22** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.04 | 0.12 | 0.05 | 0.13 | 0.11 | 0.06 | 0.06 | 0.07 | 0.05 | 0.12 | 0.04 | 0.10 | 0.12 |
| **K-40** | **1.65** | **5.43** | **1.99** | <MDA | <MDA | **2.67** | <MDA | **7.78** | <MDA | <MDA | **5.70** | **6.49** | **2.78** |
| MDA | 0.32 | 0.73 | 0.35 | 3.09 | 0.82 | 0.44 | 0.39 | 0.62 | 0.35 | 0.87 | 0.33 | 0.92 | 0.93 |
| **Mn-54** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.04 | 0.12 | 0.05 | 0.13 | 0.14 | 0.06 | 0.06 | 0.07 | 0.05 | 0.12 | 0.04 | 0.10 | 0.11 |
| **Co-58** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.07 | 0.19 | 0.08 | 0.33 | 0.30 | 0.07 | 0.16 | 0.13 | 0.08 | 0.31 | 0.06 | 0.14 | 0.16 |
| **Co-60** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.04 | 0.11 | 0.04 | 0.11 | 0.10 | 0.06 | 0.05 | 0.06 | 0.04 | 0.10 | 0.04 | 0.10 | 0.09 |
| **Zn-65** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.11 | 0.33 | 0.12 | 0.35 | 0.34 | 0.13 | 0.16 | 0.19 | 0.11 | 0.34 | 0.10 | 0.21 | 0.25 |
| **Y-88** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.06 | 0.14 | 0.06 | 0.21 | 0.20 | 0.06 | 0.09 | 0.09 | 0.06 | 0.20 | 0.04 | 0.12 | 0.15 |
| **Zr-95** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.14 | 0.39 | 0.16 | 0.68 | 0.68 | 0.14 | 0.33 | 0.24 | 0.15 | 0.70 | 0.10 | 0.26 | 0.28 |
| **Ru-103** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.12 | 0.34 | 0.14 | 0.75 | 0.79 | 0.11 | 0.45 | 0.22 | 0.13 | 0.89 | 0.08 | 0.19 | 0.21 |
| **Sb-125** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.10 | 0.29 | 0.12 | 0.30 | 0.32 | 0.14 | 0.18 | 0.18 | 0.11 | 0.31 | 0.10 | 0.24 | 0.29 |
| **I-131** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | >8hle | >8hle | >8hle | >8hle | >8hle | 2.81 | >8hle | >8hle | >8hle | >8hle | 1.99 | 5.78 | 5.99 |
| **Cs-134** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.04 | 0.12 | 0.04 | 0.11 | 0.11 | 0.05 | 0.06 | 0.06 | 0.04 | 0.11 | 0.04 | 0.10 | 0.10 |
| **Cs-137** | <MDA | **0.45** | **0.27** | **0.99** | **1.57** | <MDA | **2.14** | **0.40** | <MDA | **1.36** | **0.14** | **0.17** | **0.30** |
| MDA | 0.04 | 0.12 | 0.04 | 0.11 | 0.11 | 0.06 | 0.06 | 0.07 | 0.04 | 0.11 | 0.04 | 0.09 | 0.11 |
| **Ce-144** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.23 | 0.68 | 0.29 | 0.76 | 0.76 | 0.27 | 0.40 | 0.37 | 0.25 | 0.82 | 0.20 | 0.48 | 0.50 |
| **Eu-152** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.07 | 0.21 | 0.09 | 0.22 | 0.22 | 0.09 | 0.11 | 0.12 | 0.08 | 0.22 | 0.06 | 0.16 | 0.18 |
| **Eu-154** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.05 | 0.15 | 0.06 | 0.15 | 0.16 | 0.06 | 0.08 | 0.08 | 0.05 | 0.16 | 0.04 | 0.10 | 0.13 |
| **Eu-155** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.09 | 0.27 | 0.10 | 0.26 | 0.27 | 0.11 | 0.14 | 0.17 | 0.09 | 0.27 | 0.08 | 0.20 | 0.21 |
| **Pb-212** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | **0.08** | <MDA | <MDA |
| MDA | 0.05 | 0.15 | 0.06 | 0.14 | 0.14 | 0.06 | 0.07 | 0.05 | 0.05 | 0.14 | 0.03 | 0.10 | 0.09 |
| **Pb-214** | <MDA | **2.23** | <MDA | <MDA | <MDA | <MDA | <MDA | **1.04** | <MDA | <MDA | **0.29** | <MDA | **0.89** |
| MDA | 0.07 | 0.21 | 0.10 | 0.28 | 0.22 | 0.12 | 0.14 | 0.12 | 0.09 | 0.29 | 0.07 | 0.22 | 0.21 |
| **Ra-226** | <MDA | **4.16** | <MDA | <MDA | <MDA | <MDA | <MDA | **3.71** | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.77 | 1.98 | 0.90 | 2.29 | 2.04 | 1.05 | 1.24 | 1.11 | 0.71 | 2.42 | 0.76 | 1.85 | 1.98 |
| **Ac-228** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.19 | 0.50 | 0.20 | 0.53 | 0.56 | 0.23 | 0.28 | 0.45 | 0.21 | 0.52 | 0.17 | 0.34 | 0.43 |
| **Th-234** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.46 | 1.27 | 0.54 | 1.30 | 1.34 | 0.61 | 0.69 | 0.86 | 0.50 | 1.35 | 0.45 | 1.09 | 1.17 |
| **Am-241** | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| MDA | 0.06 | 0.16 | 0.07 | 0.15 | 0.16 | 0.08 | 0.09 | 0.11 | 0.06 | 0.17 | 0.06 | 0.14 | 0.14 |

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## 3.2.5 Summary Statistics
## Terrestrial Vegetation Radiological Monitoring
## Terrestrial Vegetation

**Tritium Levels (pCi/L) in Vegetation from SRS Perimeter Stations, 2006**

| Station | N (ND) | Average | Std Dev | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| AKN-001 | 4 ( 0 ) | 615 | 88 | 617 | 509 | 718 |
| AKN-002 | 4 ( 0 ) | 724 | 128 | 714 | 612 | 857 |
| AKN-003 | 3 ( 1 ) | 1389 | 720 | 1749 | 560 | 1858 |
| AKN-004 | 3 ( 1 ) | 389 | 179 | 436 | 191 | 539 |
| AKN-005 | 4 ( 0 ) | 521 | 394 | 399 | 218 | 1066 |
| AKN-006 | 4 ( 0 ) | 431 | 135 | 428 | 271 | 599 |
| AKN-007 | 3 ( 1 ) | 886 | 979 | 397 | 249 | 2013 |
| BWL-001 | 4 ( 0 ) | 613 | 331 | 593 | 254 | 1012 |
| BWL-002 | 4 ( 0 ) | 541 | 87 | 532 | 444 | 655 |
| BWL-003 | 3 ( 1 ) | 521 | 288 | 377 | 333 | 852 |
| BWL-004 | 3 ( 1 ) | 1268 | 253 | 1412 | 976 | 1416 |
| ALD-001 | 1 ( 3 ) | 208 | N/A | 208 | 208 | 208 |
| BWL-006 | 4 ( 0 ) | 599 | 225 | 668 | 281 | 780 |
| BWL-007 | 4 ( 0 ) | 592 | 213 | 510 | 440 | 907 |
| BWL-008 | 4 ( 0 ) | 1161 | 466 | 1105 | 744 | 1690 |
| BWL-009 | 4 ( 0 ) | 1435 | 723 | 1215 | 881 | 2429 |

N denotes number of samples; ND denotes non-detect; N/A denotes Not Applicable
Averages exclude non-detects

**Cesium-137 Levels (pCi/g) in Vegetation from SRS Perimeter Stations, 2006**

| Station | N (ND) | Average | Std Dev | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| AKN-001 | 4 ( 0 ) | 0.144 | 0.052 | 0.143 | 0.086 | 0.206 |
| AKN-002 | 0 ( 4 ) | N/A | N/A | N/A | N/A | N/A |
| AKN-003 | 4 ( 0 ) | 0.350 | 0.377 | 0.181 | 0.126 | 0.913 |
| AKN-005 | 4 ( 0 ) | 0.653 | 0.131 | 0.699 | 0.461 | 0.754 |
| AKN-006 | 4 ( 0 ) | 0.168 | 0.085 | 0.152 | 0.085 | 0.284 |
| AKN-008 | 4 ( 0 ) | 0.606 | 0.229 | 0.548 | 0.408 | 0.923 |
| BWL-004 | 4 ( 0 ) | 0.197 | 0.036 | 0.193 | 0.158 | 0.244 |
| ALD-001 | 4 ( 0 ) | 0.322 | 0.075 | 0.295 | 0.267 | 0.433 |
| BWL-006 | 4 ( 0 ) | 0.554 | 0.194 | 0.554 | 0.362 | 0.744 |

N denotes number of samples; ND denotes non-detect; N/A denotes Not Applicable
Averages exclude non-detects

**Back to TOC** **Back to 3.2.4 Vegetation Data**

## Summary Statistics
## Terrestrial Vegetation Radiological Monitoring
## Terrestrial Vegetation (cont)

**Tritium Levels (pCi/L) in SRS Perimeter Vegetation Samples, 2006**

| N (ND) | Average | Std Dev | Median | Minimum | Maximum |
|---|---|---|---|---|---|
| 56 ( 8 ) | 743 | 267 | 562 | 191 | 2429 |

**Cs-137 Levels (pCi/g) in SRS Perimeter Vegetation Samples, 2006**

| N (ND) | Average | Std Dev | Median | Minimum | Maximum |
|---|---|---|---|---|---|
| 32 ( 4 ) | 0.374 | 0.115 | 0.244 | 0.085 | 0.923 |

**Tritium Levels (pCi/L) in 25-mile Radius Vegetation Samples, 2006**

| N (ND) | Average | Std Dev | Median | Minimum | Maximum |
|---|---|---|---|---|---|
| 5 ( 7 ) | 245 | 41 | 245 | 181 | 284 |

**Tritium Levels (pCi/L) in 50-mile Radius Vegetation Samples, 2006**

| N (ND) | Average* | Std Dev* | Median* | Minimum* | Maximum |
|---|---|---|---|---|---|
| 2 ( 10 ) | 155 | 174 | 94 | 93 | 697 |

**Tritium Levels (pCi/L) in S.C. Background Vegetation Samples, 2006**

| N (ND) | Average* | Std Dev* | Median* | Minimum* | Maximum* |
|---|---|---|---|---|---|
| 0 ( 12 ) | 96 | 3 | 94 | 93 | 100.5 |

**Cs-137 Levels (pCi/g) in 50-mile Radius Vegetation Samples, 2006**

| N (ND) | Average* | Std Dev* | Median* | Minimum* | Maximum |
|---|---|---|---|---|---|
| 1 ( 11 ) | 0 | 0.009 | 0.011 | 0.010 | 0.042 |

**Cs-137 Levels (pCi/g) in S.C. Background Vegetation Samples, 2006**

| N (ND) | Average* | Std Dev* | Median* | Minimum* | Maximum |
|---|---|---|---|---|---|
| 2 ( 10 ) | 0.021 | 0.023 | 0.012 | 0.011 | 0.087 |

N denotes number of samples; ND denotes non-detect
* Includes non-detects calculated as MDA x 0.5 for statistical testing purposes

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# Summary Statistics
# Terrestrial Vegetation Radiological Monitoring
# Fungi

| All Random Plus Nonrandom Collections of Fungi Summary Statistics (2006) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SRS 50-Mile Perimeter | | | | | SC Background>50-Mile Perimeter | | | | Results > SC Bkg | | All D |
| **ID** | **#D** | **Average** | **SD** | **Median** | **#D** | **Average** | **SD** | **Median** | **Average** | **Median** | **Max D** |
| **Be-7** | 4 | 2.24 | 0.76 | 2.08 | 3 | 3.15 | 2.1 | 2.6 | <SCBkg | <SCBkg | 8.09 |
| **Cs-137** | 10 | 0.78 | 0.7 | 0.42 | 11 | 0.83 | 0.99 | 0.4 | <SCBkg | **0.02** | 3.15 |
| **K-40** | 13 | 4.31 | 2.31 | 4.1 | 14 | 5.9 | 4.03 | 4.31 | <SCBkg | <SCBkg | 15.26 |
| **Pb-212** | 1 | 0.08 | NA | 0.08 | 1 | 0.16 | NA | 0.16 | <SCBkg | <SCBkg | 0.16 |
| **Pb-214** | 4 | 1.11 | 0.81 | 0.97 | 1 | 0.44 | NA | 0.44 | **0.67** | **0.53** | 2.23 |
| **Ra-226** | 2 | 3.44 | 0.32 | 3.94 | 0 | <MDA | <MDA | <MDA | **3.44** | **3.94** | 4.16 |
| **All Random Plus Nonrandom Collections of Fungi Summary Statistics (2004-2006)** | | | | | | | | | | | |
| **SRS 50-Mile Perimeter** | | | | | **SC Background>50-Mile Perimeter** | | | | Results > SC Bkg | | All D |
| **ID** | **#D** | **Average** | **SD** | **Median** | **#D** | **Average** | **SD** | **Median** | **Average** | **Median** | **Max D** |
| **Ac-228** | 2 | 2.07 | 0.38 | 2.07 | 0 | <MDA | <MDA | <MDA | **2.07** | **2.07** | 2.34 |
| **Be-7** | 5 | 2.18 | 0.67 | 1.95 | 12 | 4.45 | 3.19 | 3.19 | <SCBkg | <SCBkg | 12.51 |
| **Co-58** | 0 | <MDA | <MDA | <MDA | 1 | 0.11 | NA | 0.11 | <SCBkg | <SCBkg | 0.11 |
| **Co-60** | 0 | <MDA | <MDA | <MDA | 1 | 0.11 | NA | 0.11 | <SCBkg | <SCBkg | 0.11 |
| **Cs-137** | 29 | 1.19 | 1.28 | 0.89 | 21 | 0.60 | 0.63 | 0.40 | **0.59** | **0.49** | 6.71 |
| **Eu-155** | 1 | 0.71 | NA | 0.71 | 0 | <MDA | <MDA | <MDA | **0.71** | **0.71** | 0.71 |
| **K-40** | 35 | 8.69 | 8.35 | 5.80 | 30 | 5.34 | 5.56 | 3.81 | **3.35** | **1.99** | 29.31 |
| **Pb-212** | 5 | 0.42 | 0.31 | 0.40 | 1 | 0.16 | NA | 0.16 | **0.26** | **0.24** | 0.83 |
| **Pb-214** | 17 | 0.67 | 0.85 | 0.31 | 12 | 0.32 | 0.14 | 0.30 | **0.35** | **0.01** | 3.30 |
| **Ra-226** | 5 | 4.03 | 3.81 | 3.71 | 4 | 0.79 | 1.46 | 0.07 | **3.24** | **3.64** | 10.23 |
| **All SC Coastal Plain Collections of Fungi Summary Statistics (2004-2006)** | | | | | | | | | | | |
| **SRS[4] 50-Mile Perimeter** | | | | | **SC Background>50-Mile Perimeter** | | | | Results > SC Bkg | | All D |
| **ID[1]** | **#D** | **Average** | **SD** | **Median** | **#D** | **Average** | **SD** | **Median** | **Average** | **Median** | **Max D** |
| **Ac-228** | 2 | 2.07 | 0.38 | 2.07 | 0 | <MDA | <MDA | <MDA | **2.07** | **2.07** | 2.34 |
| **Be-7** | 4 | 2.13 | 0.77 | 1.86 | 4 | 4.45 | 3.19 | 3.19 | <SCBkg | <SCBkg | 12.51 |
| **Co-58** | 0 | <MDA | <MDA | <MDA | 1 | 0.11 | NA | 0.11 | <SCBkg | <SCBkg | 0.11 |
| **Co-60** | 0 | <MDA | <MDA | <MDA | 1 | 0.11 | NA | 0.11 | <SCBkg | <SCBkg | 0.11 |
| **Cs-137** | 27 | 1.26 | 1.30 | 0.91 | 13 | 0.60 | 0.63 | 0.40 | **0.66** | **0.51** | 6.71 |
| **Eu-155** | 1 | 0.71 | NA | 0.71 | 0 | <MDA | <MDA | <MDA | **0.71** | **0.71** | 0.71 |
| **K-40** | 28 | 9.31 | 8.66 | 5.81 | 14 | 5.34 | 5.59 | 3.81 | **3.97** | **2.00** | 29.31 |
| **Pb-212** | 5 | 0.42 | 0.31 | 0.40 | 0 | 0.16 | NA | 0.16 | **0.26** | **0.24** | 0.83 |
| **Pb-214** | 14 | 0.71 | 0.92 | 0.30 | 7 | 0.32 | 0.14 | 0.30 | **0.39** | **0.00** | 3.30 |
| **Ra-226** | 4 | 4.11 | 4.39 | 3.02 | 2 | 0.79 | 1.46 | 0.07 | **3.32** | **2.95** | 10.23 |

Notes:
1. ID is the radionuclide abbreviation. See glossary for abbreviation identification.
2. #D is the number of sample detections.
3. SD is the standard deviation and NA is not applicable.
4. SRS 50-Mile perimeter is a circle 50-miles from a Savannah River Site centerpoint.
5. SC Bkg is the South Carolina background outside of the SRS 50-mile perimeter.
6. Max D is the maximum detection within the specified sampling time period.
7. <MDA is less than the minimum detectable activity for the radionuclide.
8. Previously reported Ce-144 detections in 2004 were <MDA (not > MDA, transcription/calculation error).
9. All data are in pCi/g.

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## 3.3 Radiological Monitoring of Edible Vegetation

### 3.3.1 Summary

Plants in general may accumulate radionuclides depending upon many factors including species, tissue type, soil-water-plant relationships, soil type, and the chemical nature of the radionuclide in the soil. Vegetation can also be contaminated internally by the uptake of radionuclides through the root system. As a result, radioactive materials could be transported through the human body via the consumption of food products containing radioactivity.

The Environmental Surveillance and Oversight Program (ESOP) began 2006 annual sampling in February. A variety of fruits and vegetables were collected in 2006. Thirty-six samples were collected from 23 sampling locations: six randomly selected background locations, and 17 randomly selected perimeter locations (Map 1, page xiii).

**RESULTS AND DISCUSSION**

Historically, the main sources of tritium releases from the Savannah River Site (SRS) operations were the reactor areas and the chemical separation facilities. Most of the tritium released was in the form of a vapor or a gas. Since 1988, those facilities have been closed, but there is a new source on line at SRS: the Tritium Extraction Facility (TEF). This facility's mission is to transfer new tritium gas to the nation's tritium inventory (CDC SRS Health Effects Subcommittee 1997). Tritium was detected in nine of the total 36 ESOP samples collected across South Carolina. Of these nine detections, the highest tritium detection, found in watermelon from a Bamberg location within 50-miles of the SRS, was 0.423 picocuries per gram (pCi/g). The lowest tritium detection, found in an apple sample from the Long Branch Quad in Barnwell, SC, was 0.192 pCi/g. No tritium detections were found in any of the nine background samples.

The ESOP program collected nine total samples that included a variety of greens (i.e., collards, mustards and wild pokeberry). Of these nine samples, two had detections of tritium: one collards sample (0.271 pCi/g) and one mustards sample (0.199 pCi/g) collected within 50-miles of the SRS. The ESOP statistical tritium values for all of South Carolina vegetation sampled averaged 0.298 pCi/g (± 0.084 pCi/g), with a median value of 0.332 pCi/g. The tritium values for locations within 50-miles of the SRS averaged 0.295 pCi/g (± 0.082 pCi/g), with a median of 0.271 pCi/g. In comparison, the DOE-SR terrestrial food product program reported tritium in one collards sample of the five greens samples analyzed for tritium. The DOE-SR tritium detection was within three standard deviations of the ESOP average detection.

In 2006, DOE-SR also collected corn and soybeans with no reported tritium detections in the samples. ESOP collected two corn samples, one within the 50-miles of the SRS having a tritium detection of 0.252 pCi/g and one outside of the 50-miles of the SRS that had no detection of tritium. ESOP collected four soybean samples which were all below the detectable limit for tritium.

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Figure 1 and Table 1 in section 3.3.2 depict the tritium concentrations in fruit for 2004-06 at SRS perimeter locations, nearest to farthest. The highest detection was in plums (0.803 pCi/g) at the

Snelling location. This detection is not necessarily associated with SRS; since there are other nuclear sources in the area. The lowest detection was in a passion fruit sample (0.189 pCi/g) at a Williston location.

Figure 2 and Table 2 in section 3.3.2 depict the tritium concentrations in greens for 2004-06 at SRS perimeter locations, nearest to farthest. Of the 19 samples of greens collected, there were only four detections of tritium. The highest detection was in collards (0.271 pCi/g) at the Gloverville location. This detection is most probably due to rainfall and could be a result of sources other than SRS. The lowest detection was in mustards (0.199 pCi/g) at another Aiken County location, Fury's Ferry Landing. The two detections for the turnips collected in Estill, SC were averaged together to get the value of 0.207 pCi/g overall for Estill.

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### 3.3.2 Tables and Figures
### Radiological Monitoring of Edible Vegetation

Figure 1. 2004-2006 Tritium in Fruit at Perimeter SRS Locations

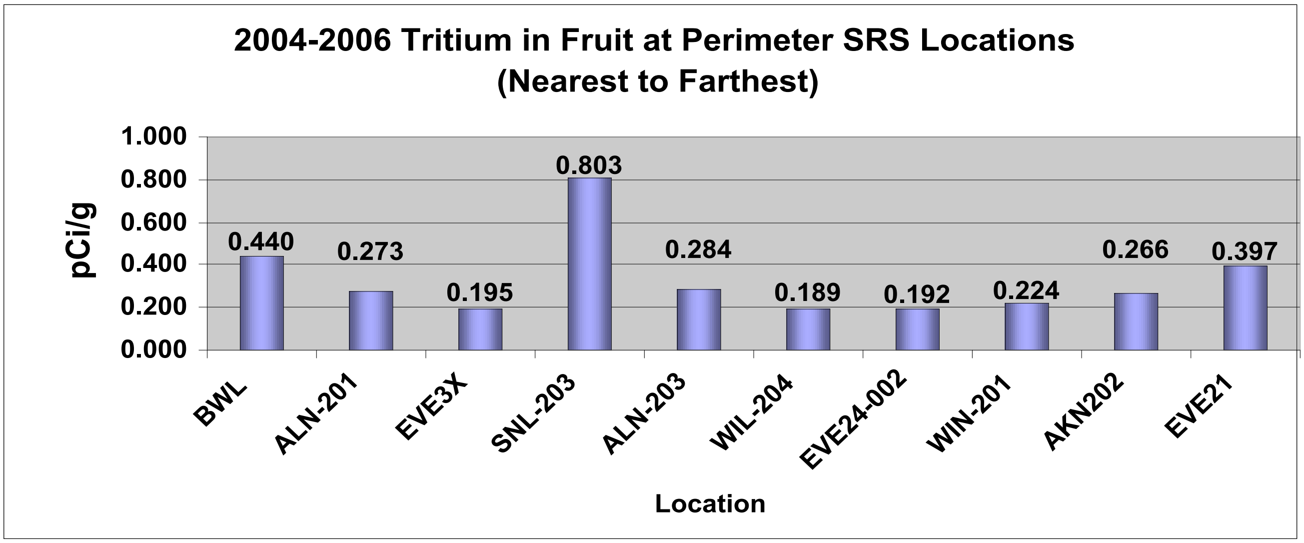


Table 1. Tritium in Fruit at Perimeter SRS Locations

| Location Name | Location # | Collected | Detection | Average | Fruit |
|---|---|---|---|---|---|
| Patterson mill | BWL-003 | 06/23/05 | 0.330 pCi/g | | Plums |
| Bill Road | BWL-004 | 06/23/05 | 0.550 pCi/g | 0.440 pCi/g | Blackberries |
| Millet & Moody | ALN-201 | 06/03/04 | 0.273 pCi/g | | Plums |
| New Ellenton | EVE3X | 10/12/05 | 0.195 pCi/g | | Grapes |
| Snelling | SNL-203 | 06/03/04 | 0.803 pCi/g | | Plums |
| Creek Plantation | ALN-203 | 06/03/04 | 0.284 pCi/g | | Plums |
| Williston | WIL-204 | 08/29/04 | 0.189 pCi/g | | Passion Fruit |
| Barnwell | EVE24-002 | 08/16/06 | 0.192 pCi/g | | Apples |
| Cedar branch Rd | WIN-201 | 10/22/04 | 0.224 pCi/g | | Persimmons |
| DHEC Office | AKN202 | 10/22/04 | 0.266 pCi/g | | Pears |
| Bamberg | EVE21-001 | 06/23/06 | 0.371 pCi/g | | Blackberries |
| Bamberg | EVE21-002 | 06/23/06 | 0.423 pCi/g | 0.397 pCi/g | Watermelon |

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## Tables and Figures
## Radiological Monitoring of Edible Vegetation

Figure 2. 2004-2006 Tritium in Greens from SRS Perimeter Locations

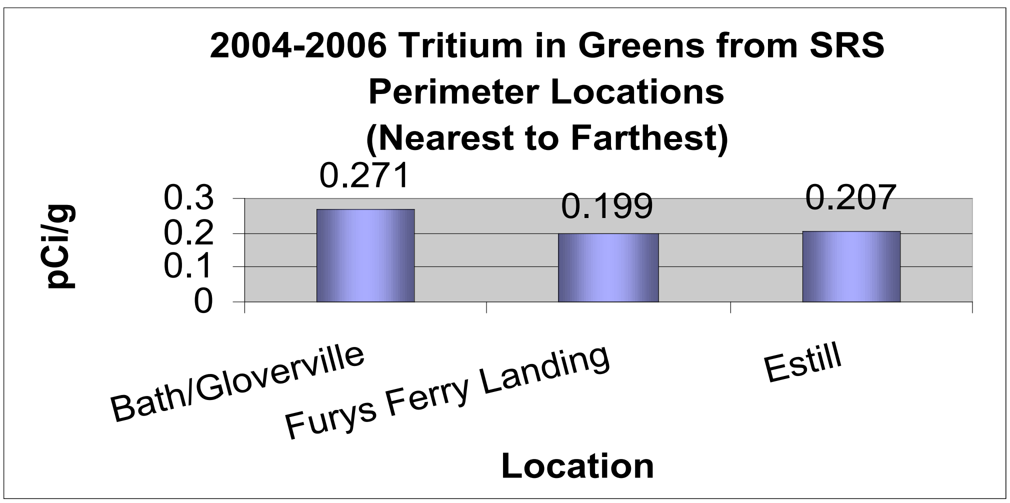


Table 2. Tritium in Greens from SRS Perimeter Locations

| Location | Location # | Collected | Food | Detection | Avg |
|---|---|---|---|---|---|
| Bath/Gloverville | EVE30-001 | 11/17/06 | Collards | 0.271 pCi/g | 0.271 pCi/g |
| Furys Ferry Landing | EVE32 | 10/26/06 | Mustards | 0.199 pCi/g | 0.199 pCi/g |
| Estill | ESTE1-001 | 06/17/05 | Turnips | 0.201 pCi/g | |
| Estill | ESTE1-002 | 06/17/05 | Turnips | 0.212 pCi/g | 0.207 pCi/g |

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## 3.3.3 Data
## Edible Vegetation Monitoring

| Sample Location: | | EVE14 | EVE12 | EVE15 | EVE19 | EVE13 | EVE17 |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 02/02/06 | 5/11/06 | 05/11/06 | 05/11/06 | 05/25/06 | 05/25/06 |
| Type | | Mustards | PokeBerry | PokeBerry | Plums | Dewberries | Pokeberry |
| Radionuclides | | | | | | | |
| Tritium | (pCi/g) | <188 | <188 | <188 | <188 | <188 | <188 |
| +/-2 | sigma | | | | | | |
| K-40 | (pCi/g) | 3.466 | 5.817 | 6.637 | 2.069 | 1.693 | 9.340 |
| +/-2 | sigma | 0.433 | 0.759 | 0.796 | 0.469 | 0.393 | 0.929 |
| MDA | | 0.159 | 0.267 | 0.333 | 0.240 | 0.219 | 0.287 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.019 | 0.036 | 0.035 | 0.027 | 0.022 | 0.037 |
| Pb-212 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.020 | 0.035 | 0.036 | 0.028 | 0.015 | 0.024 |
| Pb-214 | (pCi/g) | 0.011 | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | 0.030 | NA | NA | NA | NA | NA |
| MDA | | 0.030 | 0.071 | 0.067 | 0.052 | 0.041 | 0.654 |
| Sr-89/90 | (pCi/g) | 0.321 | NA | NA | NA | NA | NA |
| +/-2 | sigma | 0.027 | NA | NA | NA | NA | NA |
| MDC | | 0.016 | NA | NA | NA | NA | NA |

| Sample Location: | | EVE11-01 | EVE11-02 | EVE18-001 | EVE18-002 | EVE18-003 | EVE18-004 |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 05/25/06 | 05/25/06 | 06/23/06 | 06/23/06 | 06/23/06 | 06/23/06 |
| Type | | Pokeberry | Plums | Corn | Squash | Tomatoes | Potatoes |
| Radionuclides | | | | | | | |
| Tritium | (pCi/g) | <188 | <188 | 0.252 | 0.246 | 0.371 | <191 |
| +/-2 | sigma | | | 92 | 91 | 96 | |
| K-40 | (pCi/g) | 9.921 | 1.610 | 2.692 | <MDA | 2.130 | 3.310 |
| +/-2 | sigma | 0.929 | 0.389 | 0.622 | NA | 0.716 | 0.694 |
| MDA | | 0.295 | 0.228 | 0.299 | 0.288 | 0.340 | 0.294 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.313 | 0.023 | 0.040 | 0.037 | 0.038 | 0.036 |
| Pb-212 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.238 | 0.017 | 0.045 | 0.042 | 0.048 | 0.039 |
| Pb-214 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.060 | 0.046 | 0.079 | 0.074 | 0.081 | 0.076 |
| Sr-89/90 | (pCi/g) | NA | NA | NA | NA | NA | NA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDC | | NA | NA | NA | NA | NA | NA |

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## Edible Vegetation Radiological Monitoring

| Sample Location: | | EVE21-001 | EVE21-002 | EVE20-001 | EVE20-002 | EVE16-001 | EVE16-002 |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 06/23/06 | 06/23/06 | 07/12/06 | 07/12/06 | 07/12/06 | 07/12/06 |
| Type | | Blackberries | Watermelon | Cucumbers | Squash | Canteloupe | Watermelon |
| Radionuclides | | | | | | | |
| Tritium | (pCi/g) | 0.371 | 0.423 | <191 | <191 | <191 | <191 |
| +/-2 | sigma | 96 | 99 | | | | |
| K-40 | (pCi/g) | 1.347 | 1.334 | 2.114 | 1.200 | 2.067 | 0.887 |
| +/-2 | sigma | 0.579 | 0.528 | 0.574 | 0.538 | 0.573 | 0.420 |
| MDA | | 0.242 | 0.255 | 0.256 | 0.248 | 0.264 | 0.224 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.031 | 0.033 | 0.033 | 0.030 | 0.030 | 0.029 |
| Pb-212 | (pCi/g) | <MDA | <MDA | NA | NA | NA | NA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.036 | 0.039 | NA | NA | NA | NA |
| Pb-214 | (pCi/g) | <MDA | <MDA | NA | NA | NA | NA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.064 | 0.073 | NA | NA | NA | NA |
| Sr-89/90 | (pCi/g) | NA | NA | NA | NA | NA | NA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDC | | NA | NA | NA | NA | NA | NA |

| Sample Location: | | EVE24-001 | EVE24-002 | EVE22 | EVE29 | EVE29 | EVE31 |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 08/04/06 | 8/16/06 | 08/04/06 | 10/27/06 | 11/3/06 | 11/17/06 |
| Type | | Grapes | Apples | Okra | Soybeans | Soybeans | Persimmons |
| Radionuclides | | | | | | | |
| Tritium | (pCi/g) | <191 | 0.192 | 0.332 | <193 | <195 | <195 |
| +/-2 | sigma | | 89 | 95 | | | |
| K-40 | (pCi/g) | 1.386 | 1.003 | 2.709 | 8.702 | 16.16 | 2.58 |
| +/-2 | sigma | 0.407 | 0.344 | 0.401 | 0.946 | 1.264 | 0.386 |
| MDA | | 0.212 | 0.170 | 0.194 | 0.335 | 0.274 | 0.154 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.027 | 0.024 | 0.025 | 0.040 | 0.040 | 0.023 |
| Pb-212 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.047 | 0.043 | 0.043 | 0.039 | 0.083 | 0.039 |
| Pb-214 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDA | | 0.067 | 0.058 | 0.063 | 0.078 | 0.104 | 0.051 |
| Sr-89/90 | (pCi/g) | NA | NA | NA | NA | NA | NA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA |
| MDC | | NA | NA | NA | NA | NA | NA |

| Sample Location: | | EVE32 | EVE30-001 | EVE30-002 |
|---|---|---|---|---|
| Sample Date: | | 10/26/06 | 11/17/06 | 11/17/06 |
| Type | | Mustards | Collards | Collards |
| Radionuclides | | | | |
| Tritium | (pCi/g) | 0.199 | 0.271 | <195 |
| +/-2 | sigma | 89 | 94 | |
| K-40 | (pCi/g) | 4.433 | 4.102 | 3.709 |
| +/-2 | sigma | 0.706 | 0.511 | 0.494 |
| MDA | | 0.320 | 0.154 | 0.203 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA |
| MDA | | 0.040 | 0.023 | 0.023 |
| Pb-212 | (pCi/g) | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA |
| MDA | | 0.036 | 0.042 | 0.048 |
| Pb-214 | (pCi/g) | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA |
| MDA | | 0.073 | 0.059 | 0.062 |
| Sr-89/90 | (pCi/g) | 0.035 | NA | NA |
| +/-2 | sigma | 0.035 | NA | NA |
| MDC | | 0.001 | NA | NA |

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## Edible Vegetation Radiological Monitoring

| Sample Location: | | EVB6A | EVB6B | EVB24 | EVB26 | EVB27-001 | EVB27-002 | EVB27-003 | EVB25 | EVB30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | 02/08/06 | 02/08/06 | 07/05/06 | 08/04/06 | 09/21/06 | 9/21/2006 | 9/21/2006 | 11/20/2006 | 12/4/2006 |
| Type | | Broccoli | Collards | Grapes | Corn | Grapes | Tomatoes | Pears | Soybeans | Soybeans |
| Radionuclides | | | | | | | | | | |
| Tritium | (pCi/g) | <188 | <188 | <191 | <191 | <191 | <191 | <191 | <195 | <195 |
| +/-2 | sigma | | | | | | | | | |
| K-40 | (pCi/g) | 4.024 | 2.611 | <MDA | 2.169 | 1.664 | 2.066 | 1.050 | 15.37 | 15.47 |
| +/-2 | sigma | 0.514 | 0.418 | NA | 0.427 | 0.471 | 0.586 | 0.469 | 1.175 | 1.245 |
| MDA | | 0.175 | 0.181 | 0.904 | 0.219 | 0.266 | 0.303 | 0.204 | 0.230 | 0.294 |
| Cs-137 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| MDA | | 0.024 | 0.022 | 0.031 | 0.028 | 0.032 | 0.036 | 0.032 | 0.031 | 0.040 |
| Pb-212 | (pCi/g) | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| MDA | | 0.023 | 0.024 | 0.036 | 0.052 | 0.032 | 0.035 | 0.033 | 0.053 | 0.071 |
| Pb-214 | (pCi/g) | <MDA | 0.097 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| +/-2 | sigma | NA | 0.027 | NA | NA | NA | NA | NA | NA | NA |
| MDA | | 0.044 | 0.034 | 0.064 | 0.073 | 0.064 | 0.069 | 0.066 | 0.069 | 0.097 |
| Sr-89/90 | (pCi/g) | 0.076 | 0.383 | NA | NA | NA | NA | NA | NA | NA |
| +/-2 | sigma | 0.007 | 0.030 | NA | NA | NA | NA | NA | NA | NA |
| MDC | | 0.005 | 0.009 | NA | NA | NA | NA | NA | NA | NA |

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## Edible Vegetation Radiological Monitoring

SRS Comparative data (Units: pCi/g)

| | Sample Location | Sample Date | Tritium | Cs-137 | Sr-89/90 |
|---|---|---|---|---|---|
| Greens | NE-Quadrant 0-10 Miles | 1/5/06 | 0.0114 | <MDA | 0.0112 |
| | NW Quadrant 0-10 Miles | 1/5/06 | <LLD | <MDA | 0.0897 |
| | SE Quadrant 0-10 Miles | 1/5/06 | <LLD | <MDA | 0.0167 |
| | SE Quadrant 25 Miles | 1/5/06 | <LLD | <MDA | 0.0116 |
| | SW Quadrant 0-10 Miles | 1/25/06 | <LLD | 0.0386 | 0.0105 |
| Corn | NE-Quadrant 0-10 Miles | 6/29/06 | <LLD | 0.0065 | <MDA |
| | NW Quadrant 0-10 Miles | 7/6/06 | <LLD | <MDA | <MDA |
| | SE Quadrant 0-10 Miles | 6/29/06 | <LLD | <MDA | <MDA |
| | SE Quadrant 25 Miles | 6/29/06 | <LLD | <MDA | <MDA |
| | SW Quadrant 0-10 Miles | 7/6/06 | <LLD | <MDA | 0.0170 |
| Soybeans | NE-Quadrant 0-10 Miles | 8/6/06 | <LLD | <MDA | <MDA |
| | NW Quadrant 0-10 Miles | 10/16/06 | <LLD | 0.0141 | 0.0218 |
| | SE Quadrant 0-10 Miles | 8/6/06 | <LLD | <MDA | 0.0149 |
| | SE Quadrant 25 Miles | 8/6/06 | <LLD | <MDA | 0.0168 |
| | SW Quadrant 0-10 Miles | 10/16/06 | <LLD | <MDA | <MDA |

| | | | |
|---|---|---|---|
| Total Average Tritium | 0.0114 | | |
| Total Standard Deviation Tritium | N/A | | |
| Total Median Tritium | 0.0114 | | |
| | | | |
| Total Average Cesium-137 | | 0.0197 | |
| Total Standard Deviation Cesium-137 | | 0.0168 | |
| Total Median Cesium | | 0.0141 | |
| | | | |
| Total Average Strontium | | | 0.0234 |
| Total Standard Deviation Strontium | | | 0.0251 |
| Total Median Strontium | | | 0.0167 |
| **GREENS** | | | |
| Average Tritium | 0.0114 | | |
| Standard Deviation Tritium | N/A | | |
| Median Tritium | 0.0114 | | |
| | | | |
| Average Cesium-137 | | 0.0386 | |
| Standard Deviation Cesium-137 | | N/A | |
| Median | | 0.0386 | |
| | | | |
| Average Strontium 89/90 | | | 0.0279 |
| Standard Deviation Strontium 89/90 | | | 0.0346 |
| Median | | | 0.0116 |
| **SOYBEANS** | | | |
| Average Cesium-137 | | 0.0141 | |
| Standard Deviation Cesium-137 | | N/A | |
| Median | | 0.0141 | |
| | | | |
| Average Strontium 89/90 | | | 0.0179 |
| Standard Deviation Strontium | | | 0.0035 |
| Median | | | 0.0170 |

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## 3.3.4 Summary Statistics
## Edible Vegetation Radiological Monitoring

**Environmental And Background Data**

| Sample Location: | Sample Date: | Type | Tritium pCi/g | K-40 pCi/g | Pb-214 pCi/g | Sr-89/90 pCi/g |
|---|---|---|---|---|---|---|
| EVE14 | 2/2/06 | Mustards | <LLD | 3.466 | 0.011 | 0.321 |
| EVB6A | 2/8/06 | Broccoli | <LLD | 4.024 | <MDA | 0.076 |
| EVB6B | 2/8/06 | Collards | <LLD | 2.611 | 0.097 | 0.383 |
| EVE12 | 5/11/06 | PokeBerry | <LLD | 5.817 | <MDA | NA |
| EVE15 | 5/11/06 | PokeBerry | <LLD | 6.637 | <MDA | NA |
| EVE19 | 5/11/06 | Plums | <LLD | 2.069 | <MDA | NA |
| EVE13 | 5/11/06 | Dewberries | <LLD | 1.693 | <MDA | NA |
| EVE17 | 5/25/06 | Pokeberry | <LLD | 9.340 | <MDA | NA |
| EVE11-01 | 5/25/06 | Pokeberry | <LLD | 9.921 | <MDA | NA |
| EVE11-02 | 5/25/06 | Plums | <LLD | 1.610 | <MDA | NA |
| EVE18-001 | 6/23/06 | Corn | 0.252 | 2.692 | <MDA | NA |
| EVE18-002 | 6/23/06 | Squash | 0.246 | <MDA | <MDA | NA |
| EVE18-003 | 6/23/06 | Tomatoes | 0.371 | 2.130 | <MDA | NA |
| EVE18-004 | 6/23/06 | Potatoes | <LLD | 3.310 | <MDA | NA |
| EVE21-001 | 6/23/06 | Blackberries | 0.371 | 1.347 | <MDA | NA |
| EVE21-002 | 6/23/06 | Watermelon | 0.423 | 1.334 | <MDA | NA |
| EVB24 | 7/5/06 | Grapes | <LLD | NA | NA | NA |
| EVE20-001 | 7/12/06 | Cucumbers | <LLD | 2.114 | NA | NA |
| EVE20-002 | 7/12/06 | Squash | <LLD | 1.200 | NA | NA |
| EVE16-001 | 7/12/06 | Cantaloupe | <LLD | 2.067 | NA | NA |
| EVE16-002 | 7/12/06 | Watermelon | <LLD | 0.887 | NA | NA |
| EVE24-001 | 7/12/06 | Grapes | <LLD | 1.386 | <MDA | NA |
| EVE24-002 | 8/4/06 | Apples | 0.192 | 1.003 | <MDA | NA |
| EVB26 | 8/16/06 | Corn | <LLD | 2.169 | <MDA | NA |
| EVE22 | 8/4/06 | Okra | 0.332 | 2.709 | <MDA | NA |
| EVB27-001 | 9/21/06 | Grapes | <LLD | 1.664 | <MDA | NA |
| EVB27-002 | 9/21/06 | Tomatoes | <LLD | 2.066 | <MDA | NA |
| EVB27-003 | 9/21/06 | Pears | <LLD | 1.050 | <MDA | NA |
| EVE29 | 10/27/06 | Soybeans | <LLD | 8.702 | <MDA | NA |
| EVE29 | 11/3/06 | Soybeans | <LLD | 16.160 | <MDA | NA |
| EVE31 | 11/17/06 | Persimmons | <LLD | 2.580 | <MDA | NA |
| EVE32 | 10/26/06 | Mustards | 0.199 | 4.433 | <MDA | 0.035 |
| EVE30-001 | 11/17/06 | Collards | 0.271 | 4.102 | <MDA | NA |
| EVE30-002 | 11/17/06 | Collards | <LLD | 3.709 | <MDA | NA |
| EVB25 | 11/20/06 | Soybeans | <LLD | 15.370 | <MDA | NA |
| EVB30 | 12/4/06 | Soybeans | <LLD | 15.470 | <MDA | NA |
| Average | includes Background | | 0.298 | 4.319 | 0.054 | 0.204 |
| Standard Deviation | | | 0.084 | 0.743 | 0.061 | 0.174 |
| Median | | | 0.332 | 2.596 | 0.054 | 0.198 |
| n= | | | 9 | 34 | 2 | 4 |

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# Summary Statistics
# Edible Vegetation Radiological Monitoring

**Environmental Data**

| Sample Location: | Sample Date: | Type | Tritium pCi/g | K-40 pCi/g | Pb-212 pCi/g | Pb-214 pCi/g | Sr-89/90 pCi/g |
|---|---|---|---|---|---|---|---|
| EVE14 | 2/2/06 | Mustards | <LLD | 3.466 | <MDA | 0.011 | 0.321 |
| EVE12 | 5/11/06 | PokeBerry | <LLD | 5.817 | <MDA | <MDA | NA |
| EVE15 | 5/11/06 | PokeBerry | <LLD | 6.637 | <MDA | <MDA | NA |
| EVE19 | 5/11/06 | Plums | <LLD | 2.069 | <MDA | <MDA | NA |
| EVE13 | 5/11/06 | Dewberries | <LLD | 1.693 | <MDA | <MDA | NA |
| EVE17 | 5/25/06 | Pokeberry | <LLD | 9.340 | <MDA | <MDA | NA |
| EVE11-01 | 5/25/06 | Pokeberry | <LLD | 9.921 | <MDA | <MDA | NA |
| EVE11-02 | 5/25/06 | Plums | <LLD | 1.610 | <MDA | <MDA | NA |
| EVE18-001 | 6/23/06 | Corn | 0.252 | 2.692 | <MDA | <MDA | NA |
| EVE18-002 | 6/23/06 | Squash | 0.246 | <MDA | <MDA | <MDA | NA |
| EVE18-003 | 6/23/06 | Tomatoes | 0.371 | 2.130 | <MDA | <MDA | NA |
| EVE18-004 | 6/23/06 | Potatoes | <LLD | 3.310 | <MDA | <MDA | NA |
| EVE21-001 | 6/23/06 | Blackberries | 0.371 | 1.347 | <MDA | <MDA | NA |
| EVE21-002 | 6/23/06 | Watermelon | 0.423 | 1.334 | <MDA | <MDA | NA |
| EVE20-001 | 7/12/06 | Cucumbers | <LLD | 2.114 | NA | NA | NA |
| EVE20-002 | 7/12/06 | Squash | <LLD | 1.200 | NA | NA | NA |
| EVE16-001 | 7/12/06 | Canteloupe | <LLD | 2.067 | NA | NA | NA |
| EVE16-002 | 7/12/06 | Watermelon | <LLD | 0.887 | NA | NA | NA |
| EVE24-001 | 7/12/06 | Grapes | <LLD | 1.386 | <MDA | <MDA | NA |
| EVE24-002 | 8/4/06 | Apples | 0.192 | 1.003 | <MDA | <MDA | NA |
| EVE22 | 8/4/06 | Okra | 0.332 | 2.709 | <MDA | <MDA | NA |
| EVE29 | 10/27/06 | Soybeans | <LLD | 8.702 | <MDA | <MDA | NA |
| EVE29 | 11/3/07 | Soybeans | <LLD | 16.160 | <MDA | NA | NA |
| EVE31 | 11/17/06 | Persimmons | <LLD | 2.580 | <MDA | <MDA | NA |
| EVE32 | 10/26/06 | Mustards | 0.199 | 4.433 | <MDA | <MDA | 0.035 |
| EVE30-001 | 11/17/06 | Collards | 0.271 | 4.102 | <MDA | <MDA | NA |
| EVE30-002 | 11/17/06 | Collards | <LLD | 3.709 | <MDA | <MDA | NA |
| Average | includes Background | | 0.295 | 3.939 | N/A | 0.011 | 0.178 |
| Standard Deviation | | | 0.082 | 3.595 | N/A | N/A | 0.202 |
| Median | | | 0.271 | 2.636 | N/A | 0.011 | 0.178 |
| n = | | | 9 | 26 | | 1 | 2 |

**Background Data**

| Sample Location: | Sample Date: | Type | K-40 pCi/g | Pb-214 pCi/g | Sr-89/90 pCi/g |
|---|---|---|---|---|---|
| EVB6A | 2/8/06 | Broccoli | 4.024 | <MDA | 0.076 |
| EVB6B | 2/8/06 | Collards | 2.611 | 0.097 | 0.383 |
| EVB24 | 7/5/06 | Grapes | NA | NA | NA |
| EVB26 | 8/16/06 | Corn | 2.169 | <MDA | NA |
| EVB27-001 | 9/21/06 | Grapes | 1.664 | <MDA | NA |
| EVB27-002 | 9/21/06 | Tomatoes | 2.066 | <MDA | NA |
| EVB27-003 | 9/21/06 | Pears | 1.050 | <MDA | NA |
| EVB25 | 11/20/06 | Soybeans | 15.370 | <MDA | NA |
| EVB30 | 12/4/06 | Soybeans | 15.470 | <MDA | NA |
| Average | | | 5.553 | 0.097 | 0.229 |
| Standard Deviation | | | 6.150 | N/A | 0.217 |
| Median | | | 2.390 | 0.097 | 0.229 |
| n = | | | 8 | 1 | 2 |

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## 3.4 Radiological Monitoring of Dairy Milk

### 3.4.1 Summary

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) collected milk at eight cow dairy locations (five perimeter and three background, Map 10, section 3.4.2) to provide an independent source of data on concentrations of radionuclides in milk.

ESOP personnel collected the cow milk samples on a quarterly basis in 2006. Cow milk samples from each quarter were analyzed for tritium, total strontium (Sr-89/90), and select gamma-emitting radionuclides (iodine-131, cesium-137, cobalt-60).

**RESULTS AND DISCUSSION**

Tritium

Three cow milk samples collected by ESOP during 2006 had detects for tritium. The highest value was 486 ± 164 picocuries per liter (pCi/L) from a sample collected in Govan, South Carolina (MK-22). Of the 29 samples analyzed for tritium, three had detects with an average of 361 ± 108 picocuries per liter. The highest tritium value reported by Department of Energy-Savannah River (DOE-SR) was 212 pCi/L with an uncertainty of 90 pCi/L from a sample collected in North Augusta, South Carolina (WSRC 2007). The tritium results for all milk samples collected by ESOP are given in section 3.4.4. The summary statistics are shown in section 3.4.5.

Gamma-emitting Radionuclides

Iodine-131, cesium-137, and cobalt-60 are all manmade radioactive isotopes. All analytical results for these radionuclides were below the respective MDA for the eight dairy locations. For the DOE-SR samples collected, the highest concentration recorded for Cs-137 was 2.63+/-.978 (2 standard deviations) pCi/L at Gracewood, Georgia (WSRC 2007). All analytical results for gamma-emitting radionuclides are located in section 3.4.4.

Strontium

Beginning in 2006, total strontium 89/90 was analyzed instead of strontium-90. Samples were collected every quarter for total strontium analysis. All dairy locations had detections for Sr-89/90. The range for these detections was 0.58 pCi/L to 10.30 pCi/L, with the maximum detection in a perimeter sample from Govan, South Carolina and the minimum detection in a background sample from Bowman, South Carolina. The average for Sr-89/90 was 1.772 +/- 2.124 pCi/L. Statistical testing was limited to a comparison of grand averages of environmental perimeter (E) samples collected within 50 miles of the Savannah River Site (SRS) perimeter, and background samples (B) as shown in section 3.4.5. Data collected for locations closer to SRS (E) have higher tritium and strontium than background (B) locations for averaged values. All analytical results for strontium are located in section 3.4.4.

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## CONCLUSIONS AND RECOMMENDATIONS

The DOE-SR uses all analytical results, including below minimum detectable concentration (MDC), to compute means. Consequently, dairy milk analytical data comparisons between ESOP and DOE-SR were not conducted.

An evaluation of average concentrations by sampling location is included in Section 3.4.5. Data collected for locations closer to SRS (E) have higher tritium and strontium than background (B) locations for averaged values.

A large portion of the radiological activity observed in collected milk samples can be attributed to fallout from past nuclear testing. Also, radionuclides within soil and plants can potentially be redistributed as a result of farming practices and controlled burns. ESOP will continue to monitor tritium, strontium, and gamma-emitting radionuclides in cow milk to ensure the safety of milk consumption by the public. Additional dairy sources will be added to the network if and when they become available.

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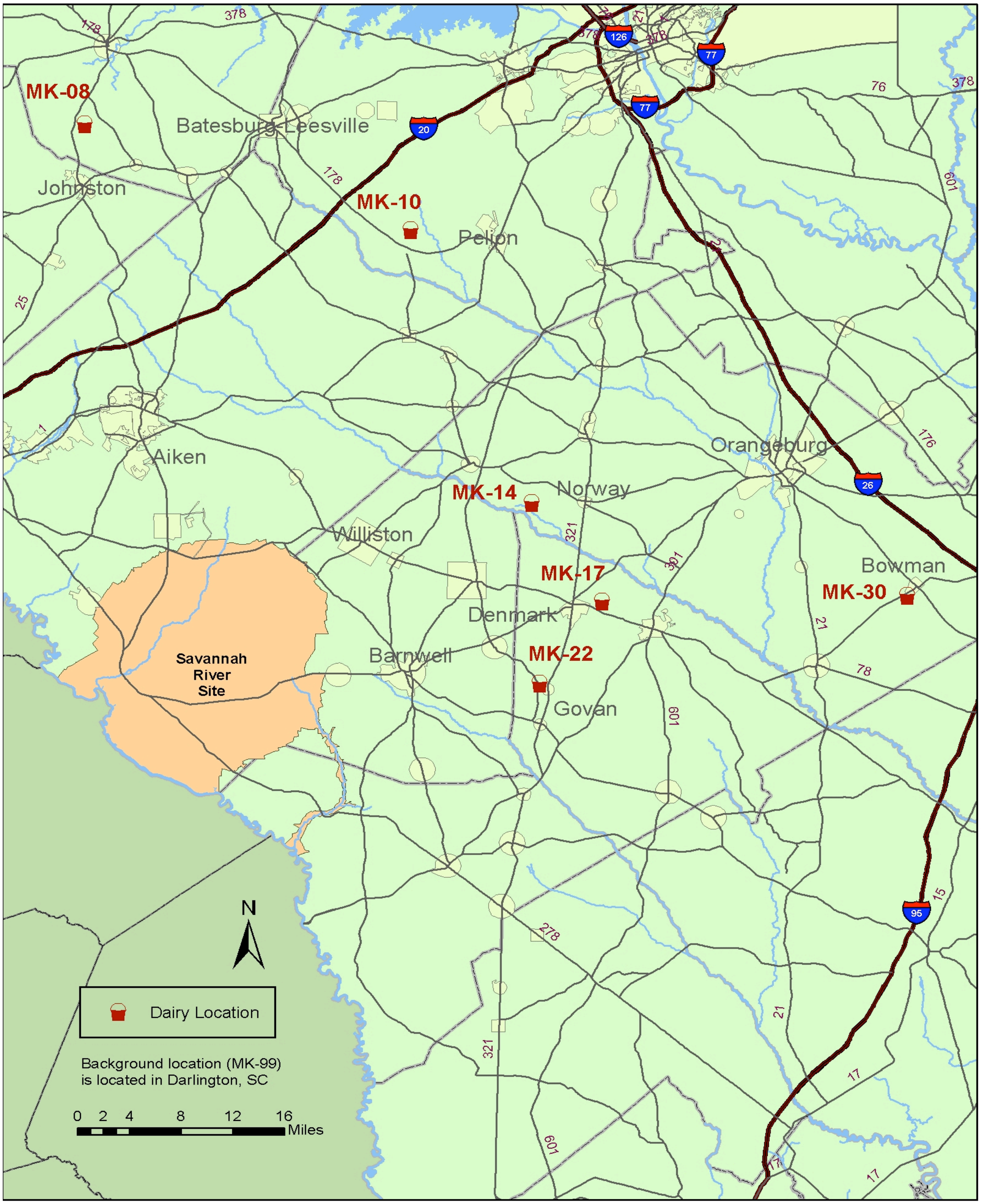
## 3.4.2
## Map 10. Radiological Monitoring of Dairy Milk Locations

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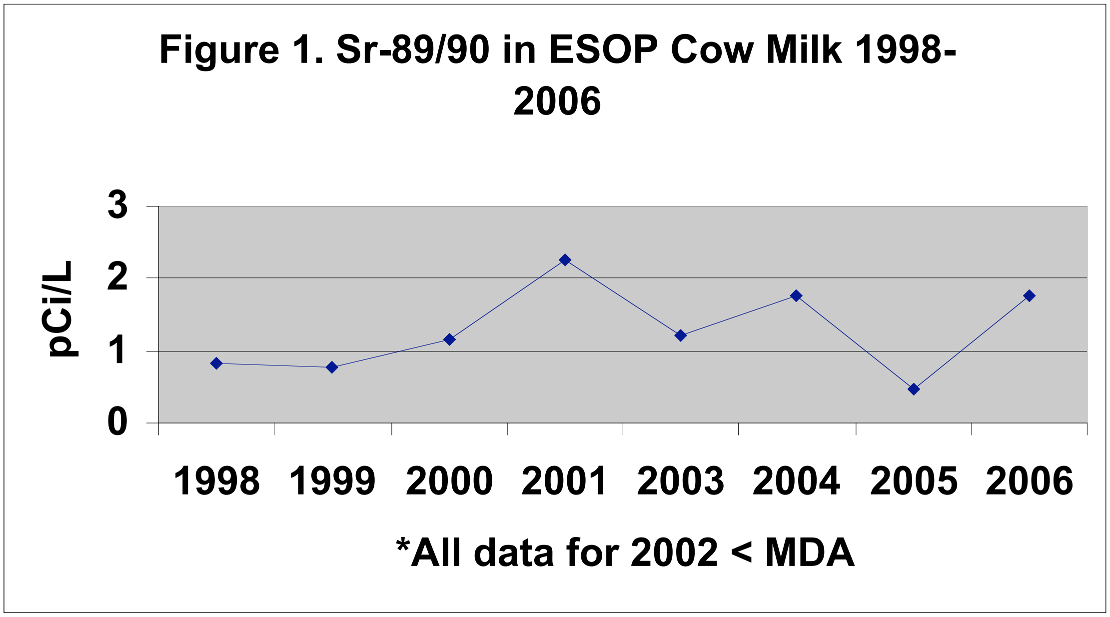
### 3.4.3 Tables and Figures
**Dairy Milk Monitoring**

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## 3.4.4 Data
## Radiological Monitoring of Dairy Milk



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## Radiological Monitoring of Dairy Milk
## Gamma and Tritium

| | | | | | |
|---|---|---|---|---|---|
| Sample ID | | MK-8 | | | |
| Sample Location | | Johnston, SC | | | |
| Collection Date | | 14-Mar-06 | 15-Jun-06 | 20-Sep-06 | 14-Dec-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | <LLD | <LLD |
| | +/- 2 SD | | | | |
| | LLD | 222EE+00 | 2.71E+02 | 2.61E+02 | 2.60E+02 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/-2 SD | | | | |
| | MDA | 2.92E+00 | 2.42E+00 | 2.22E+00 | 2.52E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/-2 SD | | | | |
| | MDA | 2.60E+02 | 2.85E+02 | 4.77E+01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.70E+00 | 2.70E+00 | 2.51E+00 | 2.70E+00 |

| | | | | | |
|---|---|---|---|---|---|
| Sample ID | | MK-10 | | | |
| Sample Location | | Leesville, SC | | | |
| Collection Date | | 14-Mar-06 | 15-Jun-06 | 25-Sep-06 | 14-Dec-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | <LLD | <LLD |
| | +/- 2 SD | | | | |
| | LLD | 2.22E+02 | 2.70E+02 | 2.61E+02 | 2.60E+02 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 3.13E+00 | 2.37E+00 | 2.44E+00 | 2.39E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 3.62E+02 | 2.64E+02 | 6.57E-01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.69E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 |

| | | | | | |
|---|---|---|---|---|---|
| Sample ID | | MK-14 | | | |
| Sample Location | | Norway, SC | | | |
| Collection Date | | 8-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | <LLD | <LLD |
| | +/- 2 SD | | | | |
| | LLD | 2.24E+02 | 2.70E+02 | 2.62E+02 | 2.55E+02 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.94E+00 | 2.46E+00 | 2.20E+00 | 2.43E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 301.7 | 4.78E+02 | 8.10E+01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.70E+00 | 1.94E+00 | 2.69E+00 | 2.70E+00 |

**Notes:**
1. SD = Standard Deviation
2. MDA = Minimum Detectable Activity
3. 8 HLE = More than 8 half lives have elapsed
4. LLD = Lower Limit of Detection

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## Radiological Monitoring of Dairy Milk
## Gamma and Tritium

| | | | | | |
|---|---|---|---|---|---|
| Sample ID | | | **MK-17** | | |
| Sample Location | | | Denmark, SC | | |
| Collection Date | | 21-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Radionuclides | Tritium (pCi/L) | <LLD | <LLD | <LLD | <LLD |
| | +/- 2 SD | | | | |
| | LLD | 2.17E+02 | 2.71E+02 | 2.62E+02 | 2.56E+02 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.84E+00 | 2.21E+00 | 2.19E+00 | 2.59E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 1.86E+02 | 4.65E+02 | 7.63E+01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.70E+00 | 2.51E+00 | 2.70E+00 | 2.70E+00 |

| | | | | | |
|---|---|---|---|---|---|
| Sample ID | | | **MK-22** | | |
| Sample Location | | | Govan, SC | | |
| Collection Date | | 8-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | **4.86E+02** | <LLD |
| | +/- 2 SD | | | **1.64E+02** | |
| | LLD | 2.28E+02 | 2.70E+02 | **2.62E+02** | 2.57E+02 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 3.18E+00 | 2.28E+00 | 2.20E+00 | 2.46E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.77E+02 | 3.18E+02 | 5.05E+01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.70E+00 | 2.61E+00 | 2.70E+00 | 2.69E+00 |

**Notes:**
1. SD = Standard Deviation
2. MDA = Minimum Detectable Activity
3. 8 HLE = More than 8 half lives have elapsed
4. LLD = Lower Limit of Detection

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## Radiological Monitoring of Dairy Milk
## Gamma and Tritium

| Sample ID | | MK-30 | | | |
|---|---|---|---|---|---|
| Sample Location | | Bowman, SC | | | |
| Collection Date | | 21-Mar-06 | 5-Jun-06 | 27-Sep-06 | 20-Dec-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | <LLD | **2.91E+02** |
| | +/- 2 SD | | | | **1.56E+02** |
| | LLD | 2.21E+02 | 2.72E+02 | 2.61E+02 | **2.55E+02** |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 3.01E+00 | 2.33E+00 | 3.25E-03 | 2.30E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.43E+02 | 3.65E+02 | 1.15E-01 | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | |
| | MDA | 2.69E+00 | 2.70E+00 | 3.96E-03 | 2.70E+00 |

| Sample ID | | MK-99 | | | | MK-15 |
|---|---|---|---|---|---|---|
| Sample Location | | Darlington, SC | | | | Newberry, SC |
| Collection Date | | 28-Mar-06 | 7-Jun-06 | 27-Sep-06 | 13-Dec-06 | 30-Mar-06 |
| Radionuclides: | Tritium (pCi/L) | <LLD | <LLD | **3.06E+02** | <LLD | <LLD |
| | +/- 2 SD | | | **1.59E+02** | | |
| | LLD | 2.21E+02 | 271 E+00 | **2.61E+02** | 254 E+00 | 233 E+00 |
| | Co-60 (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | | |
| | MDA | 2.75E+00 | 1.90E+00 | 2.15E+00 | 2.27E+00 | 2.44E+00 |
| | I-131 (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | | |
| | MDA | 1.48E+02 | 3.42E+02 | 5.46E+01 | 8 HLE | 8 HLE |
| | Cs-137 (pCi/L) | <MDA | <MDA | <MDA | <MDA | <MDA |
| | +/- 2 SD | | | | | |
| | MDA | 2.70E+00 | 2.69E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 |

**Notes:**
1. SD = Standard Deviation
2. MDA = Minimum Detectable Activity
3. 8 HLE = More than 8 half lives have elapsed
4. LLD = Lower Limit of Detection

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## Radiological Monitoring of Dairy Milk
## Strontium

| Sample Location | MK-8 | | | |
|---|---|---|---|---|
| Collection Date | 14-Mar-06 | 15-Jun-06 | 20-Sep-06 | 14-Dec-06 |
| Sr - 89/90 | **1.11E+00** | <MDC | **2.86E+00** | **7.37E-01** |
| Uncertainty | **3.96E-01** | | **9.01E-01** | **5.27E-01** |
| MDC | **6.98E-01** | 8.29E-01 | **1.43E+00** | **8.73E-01** |

| Sample Location | MK-10 | | | |
|---|---|---|---|---|
| Collection Date | 14-Mar-06 | 15-Jun-06 | 25-Sep-06 | 14-Dec-06 |
| Sr - 89/90 | <MDC | <MDC | **1.95E+00** | **1.13E+00** |
| Uncertainty | | | **7.62E-01** | **4.23E-01** |
| MDC | 5.62E-01 | 1.38E+00 | **1.22E+00** | **6.77E-01** |

| Sample Location | MK-14 | | | |
|---|---|---|---|---|
| Collection Date | 8-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Sr - 89/90 | **9.51E-01** | **1.08E+00** | **1.95E+00** | **7.11E-01** |
| Uncertainty | **5.11E-01** | **5.04E-01** | **6.80E-01** | **6.08E-01** |
| MDC | **9.18E-01** | **8.55E-01** | **1.08E+00** | **1.01E+00** |

| Sample Location | MK-17 | | | |
|---|---|---|---|---|
| Collection Date | 21-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Sr - 89/90 | **6.18E-01** | <MDC | **4.03E+00** | **1.06E+00** |
| Uncertainty | **2.25E-01** | | **7.02E-01** | **5.05E-01** |
| MDC | **3.98E-01** | 8.83E-01 | **1.04E+00** | **8.21E-01** |

| Sample Location | MK-22 | | | |
|---|---|---|---|---|
| Collection Date | 8-Mar-06 | 1-Jun-06 | 21-Sep-06 | 12-Dec-06 |
| Sr - 89/90 | <MDC | <MDC | **1.03E+01** | **1.71E+00** |
| Uncertainty | | | **9.24E-01** | **4.60E-01** |
| MDC | 6.25E-01 | 9.69E-01 | **1.20E+00** | **7.12E-01** |

| Sample Location | MK-30 | | | |
|---|---|---|---|---|
| Collection Date | 21-Mar-06 | 5-Jun-06 | 27-Sep-06 | 20-Dec-06 |
| Sr - 89/90 | **7.82E-01** | <MDC | **1.79E+00** | **5.80E-01** |
| Uncertainty | **3.16E-01** | | **4.89E-01** | **3.94E-01** |
| MDC | **5.61E-01** | 1.14E+00 | **7.58E-01** | **6.49E-01** |

| Sample Location | MK-99 | | | |
|---|---|---|---|---|
| Collection Date | 28-Mar-06 | 7-Jun-06 | 27-Sep-06 | 13-Dec-06 |
| Sr - 89/90 | **7.29E-01** | <MDC | **1.13E+00** | **9.84E-01** |
| Uncertainty | **3.31E-01** | | **7.63E-01** | **5.76E-01** |
| MDC | **5.90E-01** | 9.01E+00 | **1.26E+00** | **9.46E-01** |

| Sample Location | MK-15 |
|---|---|
| Collection Date | 30-Mar-06 |
| Sr - 89/90 | **1.02E+00** |
| Uncertainty | **3.22E-01** |
| MDC | **5.66E-01** |

**Notes:**
1. MDC= Minimum Detectable Concentration
2. Detects are in bold.

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## 3.4.5 Summary Statistics
## Radiological Monitoring of Dairy Milk

**Summary Statistics for Strontium Data (Detects only)**

| | AVERAGE | ST.DEV | MEDIAN | MIN | MAX |
|---|---|---|---|---|---|
| Sr - 89/90 | 1.772 | 2.124 | 1.08 | 0.58 | 10.3 |

**Summary Statistics for Tritium Data (Detects only)**

| | Average | SD | Median | MIN | MAX |
|---|---|---|---|---|---|
| Tritium (pCi/L) | 3.61E+02 | 1.08E+02 | 3.06E+02 | 2.91E+02 | 4.86E+02 |

**Summary Statistics for Location Averages E-B Comparison (Detects only)**

| | Perimeter Locations (<50 miles) | | | Background Locations (B) (>50 miles) | | | | |
|---|---|---|---|---|---|---|---|---|
| | Average | SD | Median | Average | SD | Median | E-B Average | E-B Median |
| Sr - 89/90 | (N=5) 2.438 | 2.011 | 1.569 | (N=3) 1.006 | 0.053 | 1.02 | 1.432 | 0.549 |
| Tritium | (N=1) 486 | NA | 486 | (N=2) 298 | 10.61 | 298 | 187 | 187 |

**Notes:**
1. MDC= Minimum Detectable Concentration
2. Detects are in bold.

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## 3.5 FFA Oversight Monitoring

### 3.5.1 Summary

The South Carolina Department of Health and Environmental Control's (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) personnel provided Quality Assurance / Quality Control (QA/QC) oversight of Department of Energy – Savannah River (DOE-SR) pre-characterization sampling activities at a selected Site Evaluation (SE) area on April 24, 2006. Oversight activities included splitting soil samples, observing sampling activities, and ensuring adherence to Washington Savannah River Company (WSRC) sampling protocol.

Observation of sampling activities and the splitting of soil samples was limited to a few locations at the Miscellaneous Rubble Pile (MSRP 631-7G). Samples were acquired through the use of hand augering. The sampling performed by DOE-SR contractors was done in accordance with established DOE-SR protocols and procedures.

Historically, the MSRP contained several large rubble piles, lumber, bricks and empty corroded drums. During the mid-1950's, the site was graded for use as storage for portable sheds (WSRC 2006).

ESOP soil sampling values were compared to the associated United States Environmental Protection Agency's Region IX Preliminary Remediation Goals (PRG) (USEPA 2004b) and the corresponding DOE-SR reported values. No exceedances beyond naturally occurring K-40 and Ra-226 were detected by ESOP sampling. However, arsenic levels above residential PRG levels were detected by DOE-SR contractors. Overall, a statistical analysis demonstrated that DOE-SR analytical averaged results were comparable to ESOP results.

**RESULTS AND DISCUSSION**

Map 11, section 3.5.2 shows the selected SE area location on the SRS. The preliminary evaluation performed by DOE-SR contractors assessed the extent of contamination at the SE area location through the sampling of soil in a key location (i.e. down-gradient). Guidance provided by the USEPA (USEPA 1992) was utilized by ESOP personnel for site inspections. No deviations from established DOE-SR sampling procedures and protocols were observed. SCDHEC's ASD performed the TAL analyses for metals on the split soil samples. No exceedances beyond naturally occurring K-40 and Ra-226 (USEPA 2004b) were detected by ESOP sampling.

A review of DOE-SR analytical data indicated detections of arsenic above the established USEPA Region IX Residential PRG for non-radionuclides. Table 1, section 3.5.3 presents all residential exceedances (**bold type**) for the split locations measured in milligrams per kilogram (mg/kg). All ESOP results are presented in section 3.5.4

A statistical analysis was performed on the soil data collected from MSRP 631-7G. Statistics were calculated for the average, median, and standard deviation for various heavy metals

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(section 3.5.5). Overall DOE-SR analytical averaged results were within two standard deviations (SD) of ESOP results.

## CONCLUSIONS AND RECOMMENDATIONS

The project attempted to evaluate DOE-SR site evaluation monitoring strategy and procedures, provide an independent source of information concerning results of monitoring, and evaluate sampling protocol through observation of sampling for adherence to established WSRC standard operating procedures. The results demonstrate that arsenic exceeded the established residential PRG. In addition, statistical tests demonstrate that the majority of DOE-SR analytical results were comparable with ESOP results.

QA/QC oversight objectives of DOE-SR contractor's pre-characterization sampling activities at this site were met and will continue at selected SE areas as needed. Continued oversight will provide assurance to the public that DOE-SR contractors' SE sampling activities adhere to prescribed procedures and independent sampling results are obtained.

Due to several lab detection levels (arsenic @ <10 mg/kg) quantified above the established PRG, it is recommended that SCDHEC laboratory processes be evaluated to determine if lower detection levels can be achieved. Otherwise, soil samples may be sent to a contract lab for reduced detection limits. However, a review of DOE-SR's background statistical report (WSRC 2006) revealed the arsenic levels detected above the residential PRG at MSRP 631-7G are typical of DOE-SR background findings.

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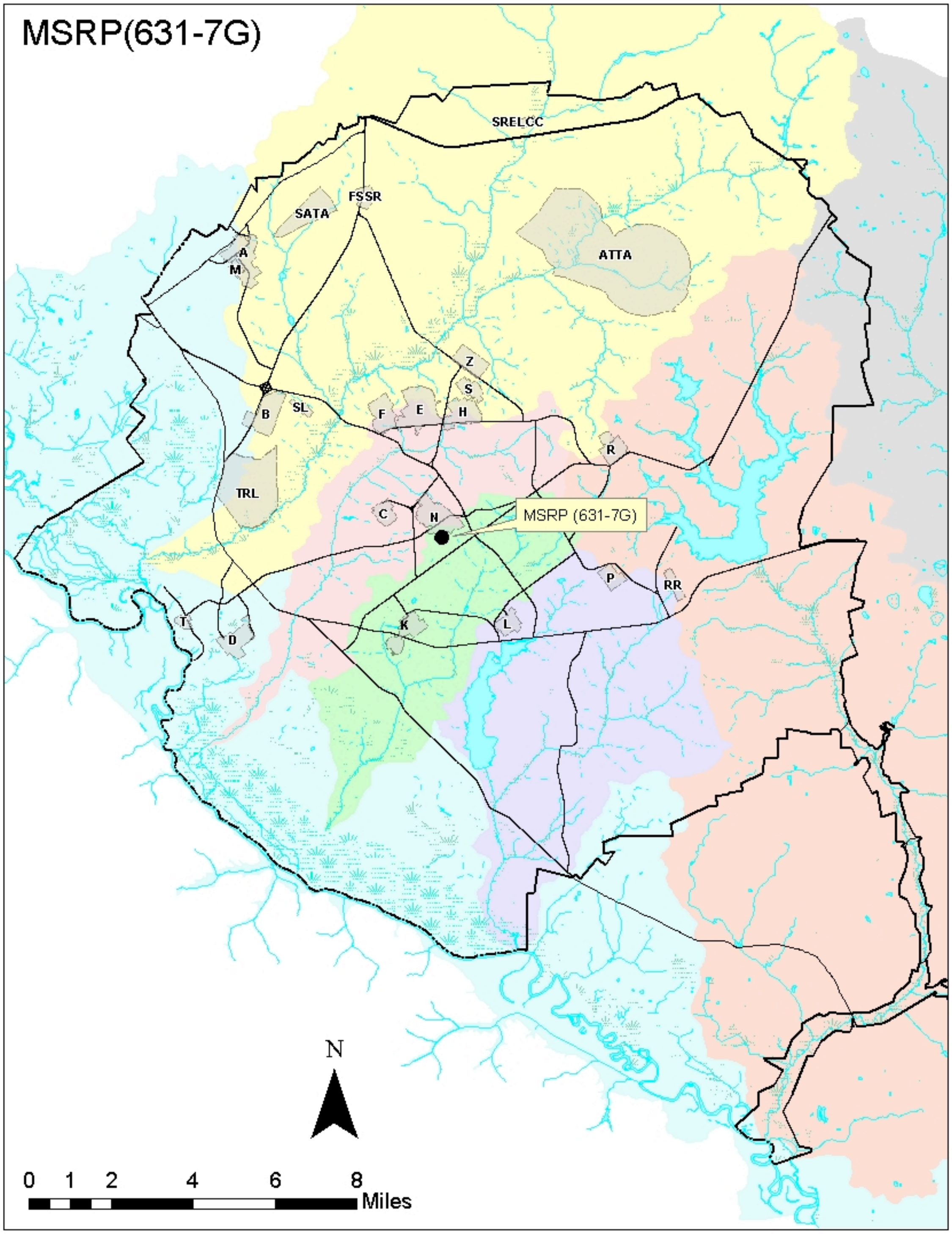
## 3.5.2
## Map 11. Federal Facility Agreement Evaluation Site




**Back to Maps**

### 3.5.3 Tables and Figures
### FFA Oversight Monitoring

Table 1 - PRG Exceedances {Miscellaneous Rubble Pile (MSRP 631-7G)}

| Analyte | Location | DOE-SR Result | SCDHEC Result | PRG Residential |
|---|---|---|---|---|
| Arsenic | MSRP92-01 | **0.596** | <10 | 0.39 |
| Arsenic | MSRP92-02 | **2.92** | <10 | 0.39 |
| Arsenic | MSRP94-01 | **1.09** | <10 | 0.39 |
| Arsenic | MSRP94-02 | **3.51** | <10 | 0.39 |
| Arsenic | MSRP107-02 | **0.633** | <10 | 0.39 |

Note:
- Results in mg/kg
- SCDHEC's lab current method detection limit is < 10 mg/kg. Future samples may be shipped to a contract lab for analysis if lower detection limits are required.
- DOE-SR statistical analytical data revealed a mean background arsenic level of 2.14 (± 2.84) (WSRC 2006)

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## 3.5.4 Data
## FFA Oversight Monitoring and Support

MSRP (631-7G)

| Sample Dates: | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 |
|---|---|---|---|---|---|
| Sample Locations: | **FFAMSRP92-01** | **FFAMSRP92-02** | **FFAMSRP94-01** | **FFAMSRP94-02** | **FFAMSRP107-02** |
| Analyte (mg/kg) | | | | | |
| 2,4,5-T | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2,4-D | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 2,4.5-TP | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Aldrin | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| alpha-BHC | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| beta-BHC | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Chlordane | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| delta-BHC | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Dieldrin | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Endosulfan I | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Endosulfan II | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Endosulfan Sulfate | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Endrin | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Endrin aldehyde | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Heptachlor | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Heptachlor epoxide | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Lindane | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| p,p'-DDD | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| p,p'-DDE | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| p,p'-DDT | 0.0034 | <0.0020 | 0.0022 | <0.0020 | <0.0020 |
| PCB 1016 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| PCB 1221 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 |
| PCB 1232 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| PCB 1242 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| PCB 1248 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| PCB 1254 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| PCB 1260 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Toxaphene | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 |
| Silver | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Aluminum | 3100 | 14000 | 6700 | 17000 | 7000 |
| Arsenic | <10 | <10 | <10 | <10 | <10 |
| Barium | 17 | 28 | 23 | 34 | 23 |
| Beryllium | <0.30 | <0.30 | <0.30 | 0.34 | <0.30 |
| Calcium | 46 | 150 | 65 | 140 | 40 |
| Cadmium | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Cobalt | <2.0 | <2.0 | <2.0 | 2.2 | <2.0 |
| Chromium | 2.8 | 11 | 4.4 | 19 | 5.5 |
| Copper | 2.1 | 5.5 | 3.1 | 10 | 2.9 |
| Iron | 1500 | 8300 | 2700 | 12000 | 2300 |
| Mercury | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Potassium | <100 | 210 | 150 | 440 | 160 |
| Magnesium | 110 | 210 | 170 | 480 | 160 |
| Manganese | 60 | 25 | 44 | 15 | 23 |
| Sodium | <10 | <10 | <10 | 27 | 17 |
| Nickel | <2.0 | 3.3 | 2.5 | 9.4 | 3.4 |
| Lead | <5.0 | 8.3 | 7.2 | 16 | 5.8 |
| Antimony | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Selenium | <10 | <10 | <10 | <10 | <10 |
| Thallium | <50 | <50 | <50 | <50 | <50 |
| Vanadium | 3.4 | 15 | 5.4 | 27 | 8.2 |
| Zinc | 4.4 | 7 | 8.2 | 18 | 6.6 |

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## Data
## FFA Oversight Monitoring and Support

| MSRP (631-7G) | | | | | |
|---|---|---|---|---|---|
| Sample Dates: | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 |
| Sample Locations: | FFAMSRP92-01 | FFAMSRP92-02 | FFAMSRP94-01 | FFAMSRP94-02 | FFAMSRP107-02 |
| Analyte (mg/kg) | | | | | |
| 1,2-dichlorobenzne | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 1,3-dichlorobenzene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 1,4-dichlorobenzene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4,5-trichlorophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4,6-trichlorophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4-dichlorophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4-dimethyl phenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4-Dinitrophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,4-dinitrotolune | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2,6-dinitrotoluene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-chloronapthalene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-chlorophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-methyl naphthalene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-methyl-4,6-dinitrophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-methylphenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-nitroaniline | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 2-nitrophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 3,3'-dichlorobenzidine | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 3-nitroaniline | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-bromophenyl phenyl ether | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-chloro-3 methyl phenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-chloroaniline | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-chlorphenyl phenyl ether | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-methyphenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-nitroaniline | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 4-nitrophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Acenaphthene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Acenaphthylene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Aniline | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Anthracene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Azobenzene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzo(a)anthracene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzo(a)pyrene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzo(b)fluoranthene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzo(ghi)perylene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzo(k)fluoranthene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzoic acid | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Benzyl alcohol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Bis(2-chloroethoxy)methane | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Bis(2-chloroethyl)ether | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Bis(2-chloroisopropyl)ether | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Bis(2-ethylhexyl)phthalate | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Butylbenzyl phthalate | <0.30 | 0.33 | 0.31 | 0.37 | 0.35 |
| Chrysene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Dibenzo(a,h)anthracene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Dibenzofuran | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Diethyl phthalate | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Dimethyl phthalate | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Di-n-butylphthalate | <0.30 | 0.92 | 0.78 | 0.87 | 0.73 |
| Di-n-octylphthalate | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |

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# Data
# FFA Oversight Monitoring and Support

| MSRP (631-7G) | | | | | |
|---|---|---|---|---|---|
| Sample Dates: | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 | 4/24/2006 |
| Sample Locations: | FFAMSRP92-01 | FFAMSRP92-02 | FFAMSRP94-01 | FFAMSRP94-02 | FFAMSRP107-02 |
| Analyte (mg/kg) | | | | | |
| Fluoranthene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Fluorene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Hexachlorobenzene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Hexachlorobutadiene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Hexachlorocyclopentadiene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Hexachloroethane | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Indeno(1,2,3-cd)pyrene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Isophorone | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Naphthalene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Nitrobenzene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| N-nitrosodimethylamine | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| N-nitrosodi-n-propylamine | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| N-nitrosodiphenylamine | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Pentachlorophenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Phenanthrene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Phenol | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| Pyrene | <0.30 | <0.30 | <0.30 | <0.30 | <0.30 |
| 1,1,1-Trichloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,1,2,2-Tetrachloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,1,2-Trichloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,1-Dichloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,1-Dichloroethene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,2-Dichloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 1,2-Dichloropropane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 2-Butanone | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 2-Hexanone | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| 4-Methyl-2-Pentanone | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Acetone | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Bromodichloromethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Bromoform | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Bromomethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Carbon Disulfide | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Carbon tetrachloride | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Chlorobenzene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Chloroethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Chloroform | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Chloromethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| cis-1,2-Dichloroethylene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| cis-1,3-Dichloropropene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Dibromochloromethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Dichloromethane | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Ethyl benzene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| m,p-Xylenes | <0.040 | <0.040 | <0.040 | <0.040 | <0.040 |
| o-Xylene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Styrene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Tetrachloroethene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Toluene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| trans-1,2-Dichloroethene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| trans-1,3-Dichloropropene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Trichloroethene | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Vinyl chloride | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |

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## 3.5.5 Summary Statistics
## FFA Oversight Monitoring and Support

| SCDHEC | | | | | | |
|---|---|---|---|---|---|---|
| **Analyte (mg/kg)** | **FFAMSRP92-01** | **FFAMSRP92-02** | **FFAMSRP94-01** | **Average** | **Standard Deviation** | **Median** |
| Aluminum | 3,100 | 14,000 | 6,700 | 7933.3 | 5554 | 6700.0 |
| Barium | 17 | 28 | 23 | 22.7 | 6 | 23.0 |
| Calcium | 46 | 150 | 65 | 87.0 | 55.4 | 65.0 |
| Chromium | 2.8 | 11 | 4.4 | 6.1 | 4.3 | 4.4 |
| Copper | 2.1 | 5.5 | 3.1 | 3.6 | 1.7 | 3.1 |
| Iron | 1,500 | 8,300 | 2,700 | 4166.7 | 3629.5 | 2700.0 |
| Lead | 2.5 | 8.3 | 7.2 | 6.0 | 3.1 | 7.2 |
| Magnesium | 110 | 210 | 170 | 163.3 | 50.3 | 170.0 |
| Manganese | 60 | 25 | 44 | 43.0 | 17.5 | 44.0 |
| Nickel | 1 | 3.3 | 2.5 | 2.3 | 1.2 | 2.5 |
| Potassium | 50 | 210 | 150 | 136.7 | 80.8 | 150.0 |
| Vanadium | 3.4 | 15 | 5.4 | 7.9 | 6.2 | 5.4 |
| Zinc | 4.4 | 7 | 8.2 | 6.5 | 1.9 | 7.0 |
| Butylbenzyl phthalate | 0.15 | 0.33 | 0.31 | 0.3 | 0.1 | 0.3 |
| Di-n-butylphthalate | 0.15 | 0.92 | 0.78 | 0.6 | 0.4 | 0.8 |
| **WSRC** | | | | | | |
| **Analyte (mg/kg)** | **FFAMSRP92-01** | **FFAMSRP92-02** | **FFAMSRP94-01** | **Average** | **Standard Deviation** | **Median** |
| Aluminum | 2,810 | 10,300 | 3,640 | 5583.3 | 4106 | 3640.0 |
| Barium | 23.7 | 35.1 | 20.7 | 26.5 | 8 | 23.7 |
| Calcium | 80.8 | 294 | 78.7 | 151.2 | 123.7 | 80.8 |
| Chromium | 2.75 | 12.1 | 3.44 | 6.1 | 5.2 | 3.4 |
| Copper | 1.39 | 3.14 | 2.15 | 2.2 | 0.9 | 2.2 |
| Iron | 1740 | 10600 | 2,250 | 4863.3 | 4974.6 | 2250.0 |
| Lead | 3.56 | 5.41 | 4.59 | 4.5 | 0.9 | 4.6 |
| Magnesium | 65.2 | 137 | 99.4 | 100.5 | 35.9 | 99.4 |
| Manganese | 68.5 | 16.1 | 52.2 | 45.6 | 26.8 | 52.2 |
| Nickel | 0.968 | 2.37 | 1.27 | 1.5 | 0.7 | 1.3 |
| Potassium | 56.5 | 98.2 | 70 | 74.9 | 21.3 | 70.0 |
| Vanadium | 4.17 | 24 | 5.46 | 11.2 | 11.1 | 5.5 |
| Zinc | 3.9 | 4.95 | 7.09 | 5.3 | 1.6 | 5.0 |
| Butylbenzyl phthalate | 0.35 | 0.37 | 0.35 | 0.4 | 0.0 | 0.4 |
| Di-n-butylphthalate | 0.35 | 0.37 | 0.35 | 0.4 | 0.0 | 0.4 |

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## Summary Statistics
## FFA Oversight Monitoring and Support

| SCDHEC | | | | | |
|---|---|---|---|---|---|
| **Analyte (mg/kg)** | **FFAMSRP94-02** | **FFAMSRP107-02** | **Average** | **Standard Deviation** | **Median** |
| Aluminum | 17,000 | 7,000 | 12000.0 | 7071 | 12000.0 |
| Barium | 34 | 23 | 28.5 | 8 | 28.5 |
| Calcium | 140 | 40 | 90.0 | 70.7 | 80.4 |
| Chromium | 19 | 5.5 | 12.3 | 9.5 | 12.3 |
| Copper | 10 | 2.9 | 6.5 | 5.0 | 6.5 |
| Iron | 12,000 | 2,300 | 7150.0 | 6858.9 | 7150.0 |
| Lead | 16 | 5.8 | 10.9 | 7.2 | 10.9 |
| Magnesium | 480 | 160 | 320.0 | 226.3 | 320.0 |
| Manganese | 15 | 23 | 19.0 | 5.7 | 19.0 |
| Nickel | 9.4 | 3.4 | 6.4 | 4.2 | 6.4 |
| Potassium | 440 | 160 | 300.0 | 198.0 | 300.0 |
| Vanadium | 27 | 8.2 | 17.6 | 13.3 | 17.6 |
| Zinc | 18 | 6.6 | 12.3 | 8.1 | 12.3 |
| Butylbenzyl phthalate | 0.37 | 0.35 | 0.4 | 0.0 | 0.4 |
| Di-n-butylphthalate | 0.87 | 0.73 | 0.8 | 0.1 | 0.8 |
| **WSRC** | | | | | |
| **Analyte (mg/kg)** | **FFAMSRP94-02** | **FFAMSRP107-02** | **Average** | **Standard Deviation** | **Median** |
| Aluminum | 10,700 | 5,100 | 7,900 | 3959.8 | 7,900 |
| Barium | 35.1 | 26.6 | 31 | 6.0 | 31 |
| Calcium | 247 | 94.7 | 171 | 107.7 | 171 |
| Chromium | 11.9 | 4.24 | 8 | 5.4 | 8 |
| Copper | 2.92 | 2.17 | 2.5 | 0.5 | 2.5 |
| Iron | 11800 | 2460 | 7130.0 | 6604.4 | 7130.0 |
| Lead | 5.54 | 2.78 | 4.2 | 2.0 | 4.2 |
| Magnesium | 160 | 76.4 | 118.2 | 59.1 | 118.2 |
| Manganese | 14.6 | 32.8 | 23.7 | 12.9 | 23.7 |
| Nickel | 2.5 | 1.84 | 2.2 | 0.5 | 2.2 |
| Potassium | 101 | 56 | 78.5 | 31.8 | 78.5 |
| Vanadium | 29.5 | 7.66 | 18.6 | 15.4 | 18.6 |
| Zinc | 5.68 | 4.63 | 5.2 | 0.7 | 5.2 |
| Butylbenzyl phthalate | 0.37 | 0.37 | 0.4 | 0.0 | 0.4 |
| Di-n-butylphthalate | 0.37 | 0.37 | 0.4 | 0.0 | 0.4 |

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## 4.1 Radiological Monitoring of Fish Adjacent To SRS

### 4.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) conducts fish monitoring for radionuclide activity in an effort to determine the magnitude, extent, and trends of radionuclide levels. Largemouth bass (*Micropterus salmoides*) and catfish (*Ameiurus catus* or *Ictalurus punctatus*) were collected from ten established sample locations and three random locations. Studies have shown that these species bioaccumulate measurable amounts of radionuclides. Common carp (*Cyprinis carpio*) were also collected as part of an ongoing effort to sample additional species each study year. Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), and striped mullet (*Mugil cephalus*) were collected near Savannah, Georgia.

Fish were collected using boat-mounted electrofishing equipment. Samples were collected at five stations where creeks from the Savannah River Site (SRS) meet the Savannah River (Map 12, section 4.1.2). Samples were also collected from an upstream tributary of the river, one Savannah River station upstream of the SRS, and four stations downstream of the SRS. All these locations are accessible to the public. Typically, five fish of each species were collected at each sample location. Each species was separated into edible and nonedible portions, and the portions were combined into homogeneous composites. Edible composites were analyzed for gamma-emitting isotopes and tritium. Nonedible composites were analyzed for gamma-emitters and strontium.

Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the Department of Energy-Savannah River (DOE-SR) Radiological Fish Monitoring Program. The information provided will assist in advising, informing, and protecting the people at risk, and in comparing current and historical data. The additional species collected in 2007 will be chain pickerel (*Esox niger*) as available.

**RESULTS AND DISCUSSION**

Fish collections were conducted from April 12 through November 14, 2006. Five largemouth bass were collected from all Savannah River locations and the Stevens Creek background site; three bass were collected from the random locations. Five channel catfish were collected at two Savannah River locations; one was collected from Stevens Creek. Five white catfish were collected at the other seven river locations and one random background site; three white catfish were collected at the other background location and none were collected from the other random site near SRS. Due to the large size of the common carp encountered, only three individuals were collected. Carp were collected at all nine Savannah River stations, but not from Stevens Creek or the random locations. Five spotted seatrout and five mullet were collected from the saltwater location; only two red drum were collected.

A total of 152 fish was collected. Sixty-three composites, one single, and three individual fish samples were processed. The Region 5 tritium laboratory analyzed aliquots from all edible samples except the individual catfish. Edible and non-edible samples were sent to the

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Radiological Environmental Monitoring Division (REMD) for radiological analysis of gamma-emitting radionuclides. Portions of some non-edible samples were sent to Eberline Services for strontium analysis. Activity levels of radionuclides for all samples are reported in Section 4.1.4. Summary statistics are presented in Section 4.1.5. SCDHEC historical data from 2002 – 2006 are reported in Section 4.1.4. Tritium results represent the activity level in the water distilled from the fish tissue. Cesium results represent the activity level in the wet sample itself. Strontium data are presented as dry and wet (converted) results.

Tritium

Activity levels of tritium were analyzed in 39 edible portions of bass, catfish, and carp composites, one single fish, and one individual sample. All freshwater stations exhibited detectable tritium activity in 2006 (Figure 1a, section 4.1.3), as did the saltwater sampling location. This was the first time ESOP analysis produced detectable tritium levels at the Stevens Creek location. The Stevens Creek station is located above a spillway for a hydroelectric generating plant, which completely blocks movement of fish from the lower Savannah River. Stevens Creek data were not used to calculate averages in Savannah River fish.

All nine bass samples from the Savannah River exhibited detectable tritium activity, with an average of 850 ± 1010 pCi/L. The composite from the Fourmile Creek location had the highest reported tritium activity, 2920 pCi/L.

Seven of nine Savannah River catfish samples exhibited tritium activity, with an average of 832 ± 767 pCi/L. The highest tritium level observed in the catfish composites, 2104 pCi/L, was from the Steel Creek location.

All nine of the carp samples exhibited tritium activity, with an average of 809 ± 849 pCi/L. The highest tritium level exhibited, 2879 pCi/L, was from the Steel Creek location.

Samples from downstream of SRS exhibited little tritium activity in 2006. 2006 data were generally similar to ESOP historically reported data (Figures 1b,1c, section 4.1.3)
All three saltwater species collected exhibited detectable tritium activity, although at levels close to the Lower Limit of Detection (LLD). None of the randomly selected locations, background or near-SRS, produced detectable tritium activity.

Cesium

Activity levels of Cs-137 were analyzed in 63 edible and nonedible portions of bass, catfish, and carp composites, one single sample, and three individual samples. The Stevens Creek background location, NSBLD, and the Hwy. 301 did not produce Cs-137 activity in any sample (Figure 2a/3a/4, section 4.1.3); neither did the random or saltwater locations. Consistent with historically reported ESOP data, higher levels of Cs-137 were reported from locations adjacent to the SRS (Figure 2b,2c/3b,3c, section 4.1.3) (SCDHEC 2006c). Five of nine edible bass composites from Savannah River locations exhibited detectable levels of Cs-137, ranging from 0.039 to 0.391 pCi/g, with an average of 0.181 ± 0.140 pCi/g. The sample from the Lower Three Runs location had the highest reported activity level. Cs-137 levels reported above the

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Minimum Detectable Activity (MDA) were observed in edible bass composites from four locations adjacent to the SRS and the Stokes Bluff area. Cs-137 activity was detected in nonedible bass composites from three creek mouth locations adjacent to SRS but not anywhere else.

Four edible catfish composites, from locations adjacent to SRS and the Hwy. 17 freshwater location, exhibited detectable levels of Cs-137. The Cs-137 levels in these samples ranged from 0.035 to 0.135 pCi/g, with an average of 0.079 ± 0.048 pCi/g. Three nonedible catfish composites produced detectable Cs-137 activity. The Lower Three Runs location exhibited the highest activity for both the edible sample and nonedible samples.

Three of nine edible carp composites from Savannah River locations exhibited detectable levels of Cs-137, ranging from 0.048 to 0.088 pCi/g. The sample from the Lower Three Runs location had the highest reported activity level.

Strontium

Portions of 25 nonedible composites from sampling locations were selected for Sr-89,90 analysis in 2006. All Savannah River locations produced detectable strontium activity (Figure 5a, section 4.1.3). The seatrout composite from near Savannah, Georgia, was the only sample in which strontium was not detected. Sr-89,90 levels reported are for wet results, calculated from the actual dry analysis. Averages noted below include the Stevens Creek and Savannah River locations, freshwater species only.

Levels of Sr-89,90 in bass ranged from 0.038 to 0.187 pCi/g, with an average of 0.092 ± 0.044 pCi/g. The sample from the Upper Three Runs location had the highest reported activity level, the upstream control station on Stevens Creek exhibited the second highest.

Strontium levels in catfish samples ranged from 0.036 to 0.097 pCi/g, with an average of 0.060 ± 0.016 pCi/g. The Steel Creek location exhibited the highest activity.

All randomly selected locations and the red drum (saltwater) produced detectable Sr-89,90 activity. Strontium-90 is present around the world as a result of fallout from past atmospheric nuclear weapons tests.

Figures 5b and 5c show historically reported ESOP data for Sr-89,90 (SCDHEC 2006c). The data reflects the results of the dry analysis of the samples because no wet/dry conversion ratios were available for most of the data. Results are highly variable.

Individual Fish Analyses

Larger, older fish may bioaccumulate more contaminants over time (USEPA 2000b). ESOP analyzed and compared data from two large fish versus the composite they were a part of in order to ascertain the impact a large fish might have on a composite sample. One bass from the Fourmile Creek location, edible portion only, was analyzed separately for tritium and gamma activity. One catfish from Stokes Bluff was analyzed for gamma activity only.

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An aliquot of the edible single bass sample portion, but not the catfish sample, was analyzed for tritium. The tritium detected in the large bass sample, 2421 pCi/L, was the second highest activity found in 2006, and the corresponding composite sample produced the highest activity level, 2920 pCi/L, of any sample in 2006. Similarly, the gamma analysis of the individual fish produced the highest Cs-137 activity of any sample collected in 2006, and the corresponding composite sample had the second-highest.

Results of the cesium-137 analysis of the single and composite catfish samples did not produce detectable activity in either the edible or nonedible portions.

Random Sampling

Three locations, two background and one near-SRS, within three randomly selected quadrants around South Carolina were sampled in 2006. Largemouth bass and white catfish were collected at the two background locations; only bass were collected at the other location. Neither tritium nor Cs-137 was detected in any of the samples. Sr-89,90 was detected in the non-edible samples from all locations.

DOE-SR Program

ESOP bass and catfish data collected for this project in 2006 was compared to DOE-SR reported information (WSRC 2007). Data comparison summaries are located in section 4.1.4. One difference between the two programs is that ESOP analyzes one composite type from each species for each location, whereas the DOE-SR program analyzes three per location. Therefore, a single composite for an ESOP location was compared to the average of the three DOE-SR composites reported.

Both ESOP and DOE-SR found detectable tritium levels at the location upstream of SRS near Augusta, Georgia. ESOP detected tritium in at least one sample from all locations, while DOE-SR did not detect tritium at four locations. ESOP tritium values from largemouth bass were consistently higher than the DOE-SR data. ESOP detected tritium in seven catfish samples, DOE-SR detected tritium in only one. Cs-137 was detected in largemouth bass from most locations by both programs in 2006, especially adjacent to SRS, but not as frequently in catfish. Cs-137 results for bass and catfish from ESOP and DOE-SR were less than 1.00 pCi/g. Strontium-89,90 was detected at all locations by both programs, although all values were less than 1.00 pCi/g.

For direct comparisons of data between the two programs, only averages of detections were used. For tritium in largemouth bass, DOE-SR results were within one standard deviation of the ESOP results. For all Cs-137 samples, DOE-SR results were within one standard deviation of the ESOP results. Sr-89,90 results for bass were within one standard deviation; catfish were within three standard deviations. Differences in these results could be attributed to the natural variation in bioaccumulation among individual fish, as evidenced by the variation in the single versus composite fish samples analyzed by ESOP. In 1999, catfish samples were collected and split between SCDHEC and DOE-SR for analyses, and no great differences in the data results were found.

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## CONCLUSIONS AND RECOMMENDATIONS

A review of ESOP data indicates that DOE-SR operations have impacted fish. Higher levels of radionuclides are found in Savannah River fish collected adjacent to and downstream of SRS compared to upstream. Fish from background locations tend not to exhibit detectable levels of man-made radionuclides, except for Sr-89,90, which is present worldwide from past nuclear weapons testing (USEPA 2007).

The project attempted to determine if activity levels in larger fish might impact a composite of relatively smaller fish. Separate portions of one bass and one catfish, considerably larger than the other fish sampled, were analyzed and compared to their respective composites. Results of the tritium and gamma analyses of the bass indicated that the older, larger fish probably made a significant contribution to the composite sample. Gamma analysis of the catfish did not produce a Cs-137 detection in the individual or composite samples. Collections of larger fish will continue in 2007 to provide additional data for assessment.

ESOP project data was compared to DOE-SR reported information (WSRC 2007). Based on standard deviations, compared tritium, Cs-137, and Sr-89,90 data were generally similar. Differences in results could be due to the natural variation of radionuclide levels in individual fish. Both programs detected Sr-89,90 at all locations.

The ESOP 2006 fish collections included common carp. The ESOP monitoring program will collect chain pickerel (*Esox niger*), as available, in addition to the target species in 2007. This will augment the existing data on Savannah River fish, and provide information for human health assessment.

Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the DOE-SR Radiological Fish Monitoring Program. Continued monitoring will provide a better understanding of actual radionuclide levels, their extent, and trends. Several important benefits can be realized as a result. Foremost is the ability for SCDHEC Bureau of Water and the Division of Health Hazard Evaluation to further evaluate the potential human health risk associated with consumption of Savannah River fish. SCDHEC will be able to better advise, inform, and protect those people at risk. Another benefit will be the ability to compare this data with historical data. Data comparison will also be part of the further evaluation of the DOE-SR program, allowing the data reported by DOE-SR to be verified. This independent verification will provide credibility and confidence in the DOE-SR data and its uses.

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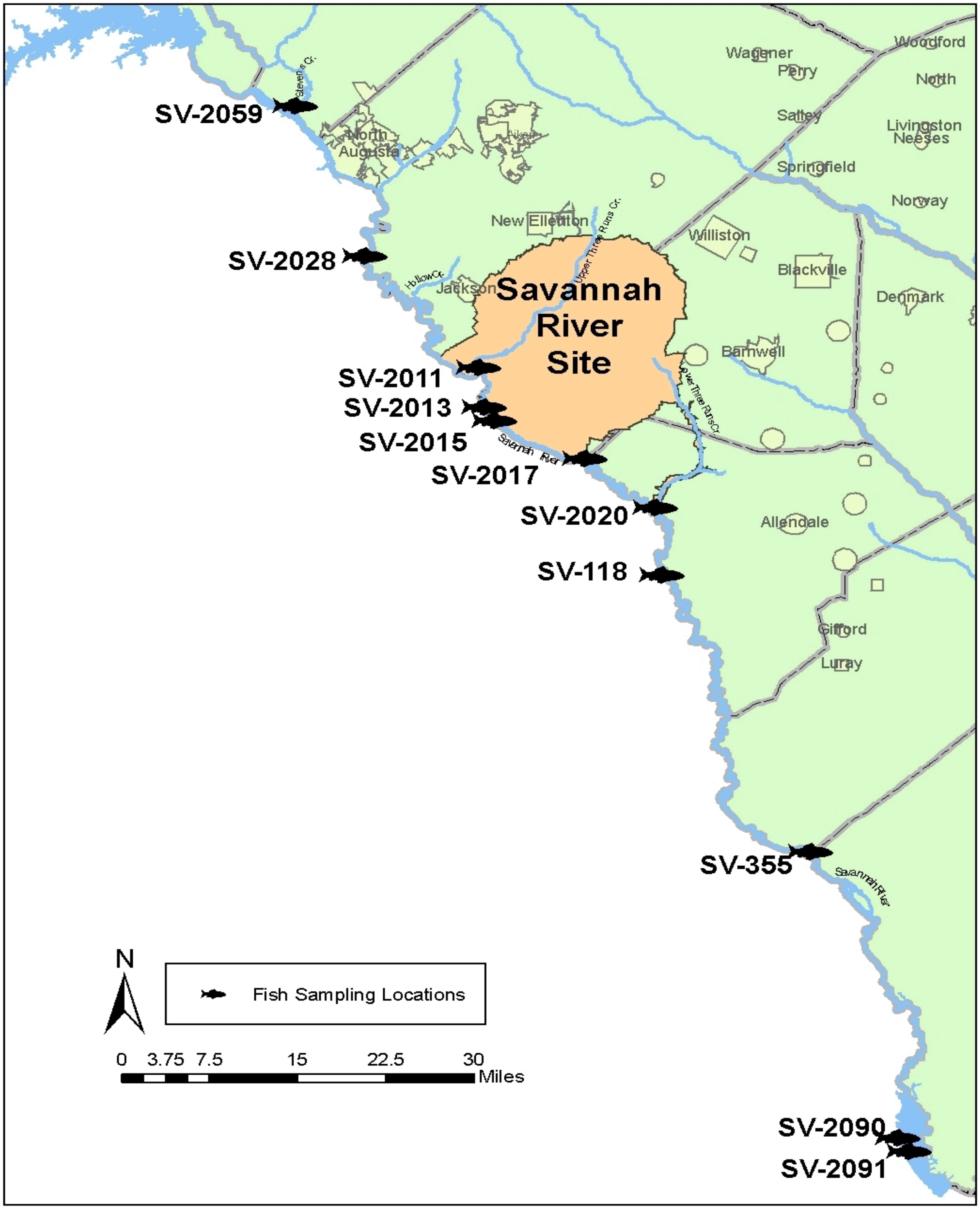
## 4.1.2
## Map 12. Radiological Monitoring of Fish Locations

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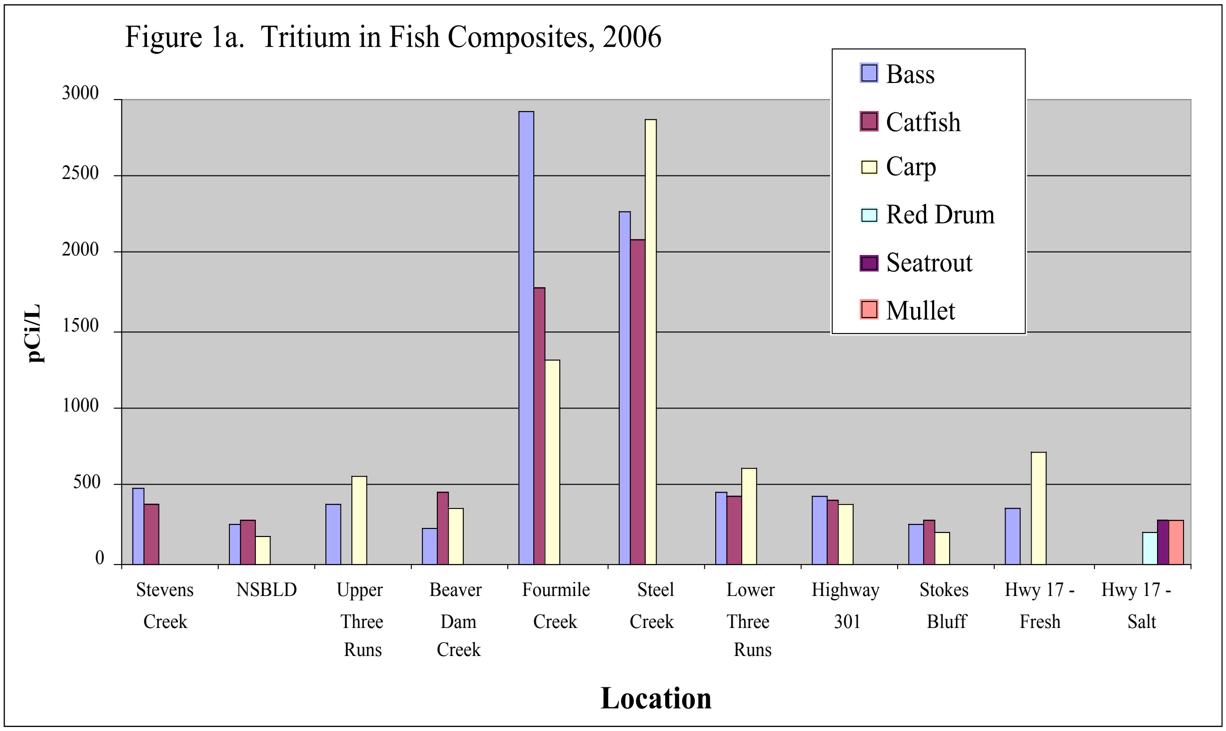
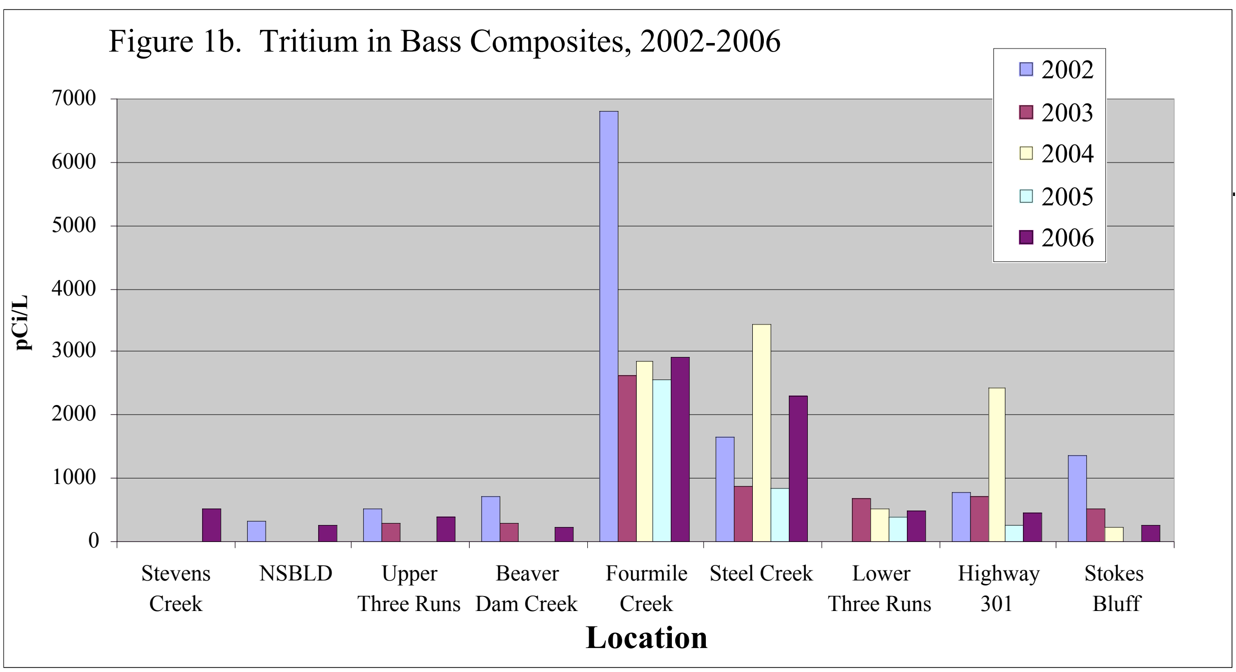
### 4.1.3 Tables and Figures
### Radiological Fish Monitoring

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## Tables and Figures
## Radiological Fish Monitoring

Figure 1c. Tritium in Catfish Composites, 2002-2006

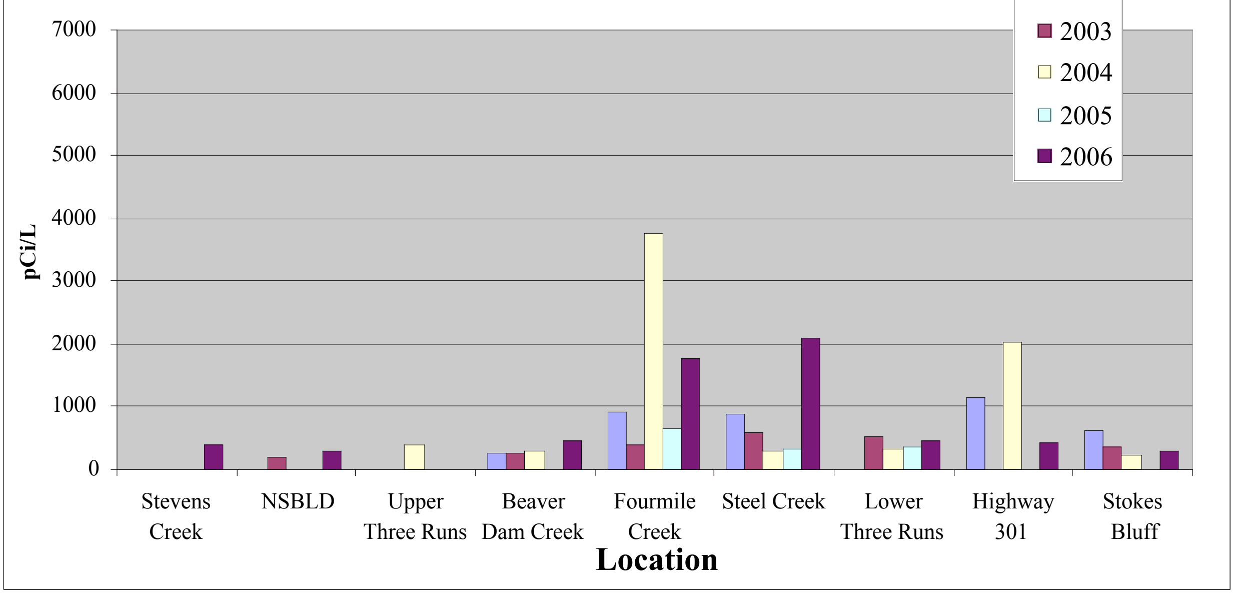
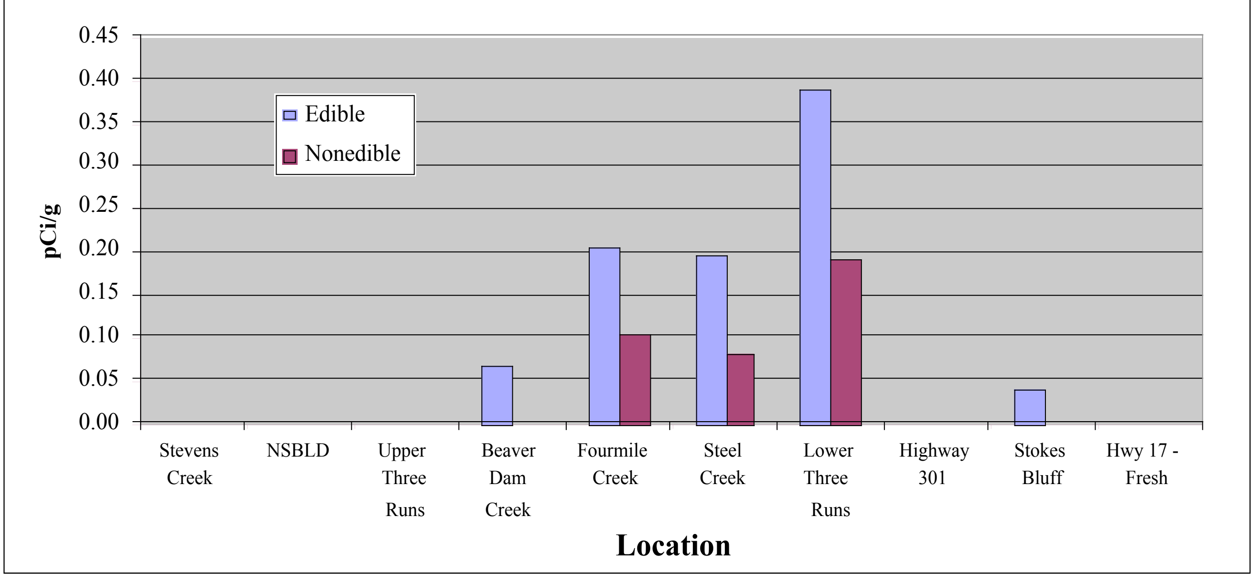



Figure 2a. Cesium-137 in Bass Composites, 2006

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## Tables and Figures
## Radiological Fish Monitoring

Figure 2b. Cs-137 in Edible Bass Composites, 2002-2006

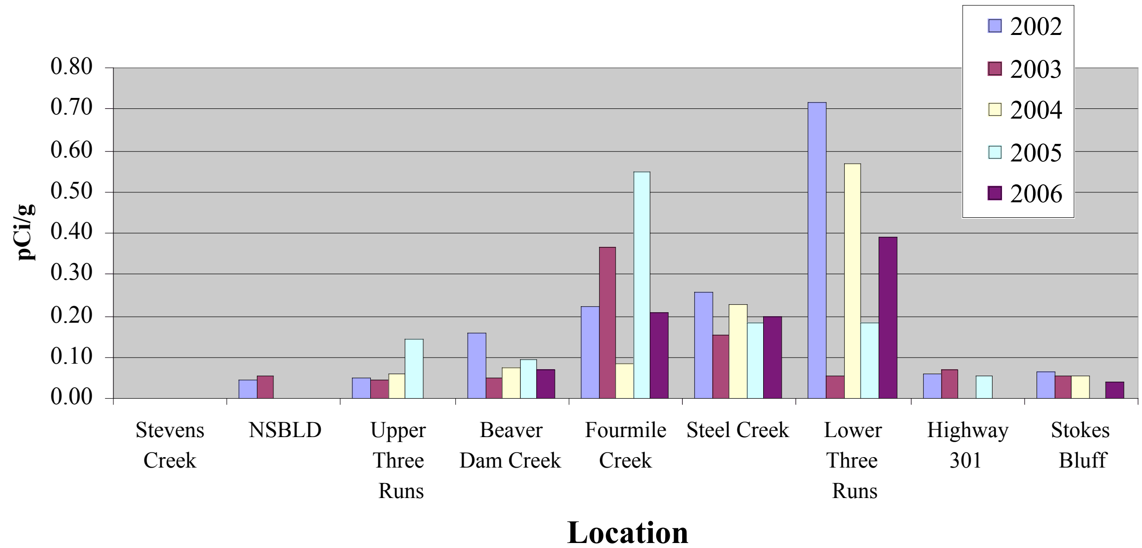
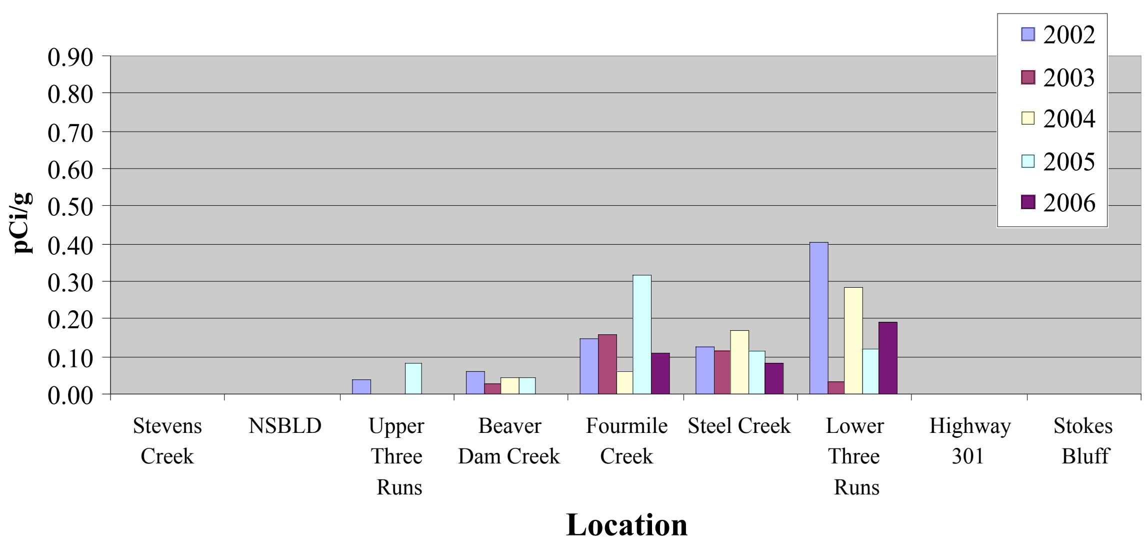



Figure 2c. Cs-137 in Non-edible Bass Composites, 2002-2006

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# Tables and Figures
## Radiological Fish Monitoring

Figure 3a. Cesium-137 in Catfish Composites, 2006

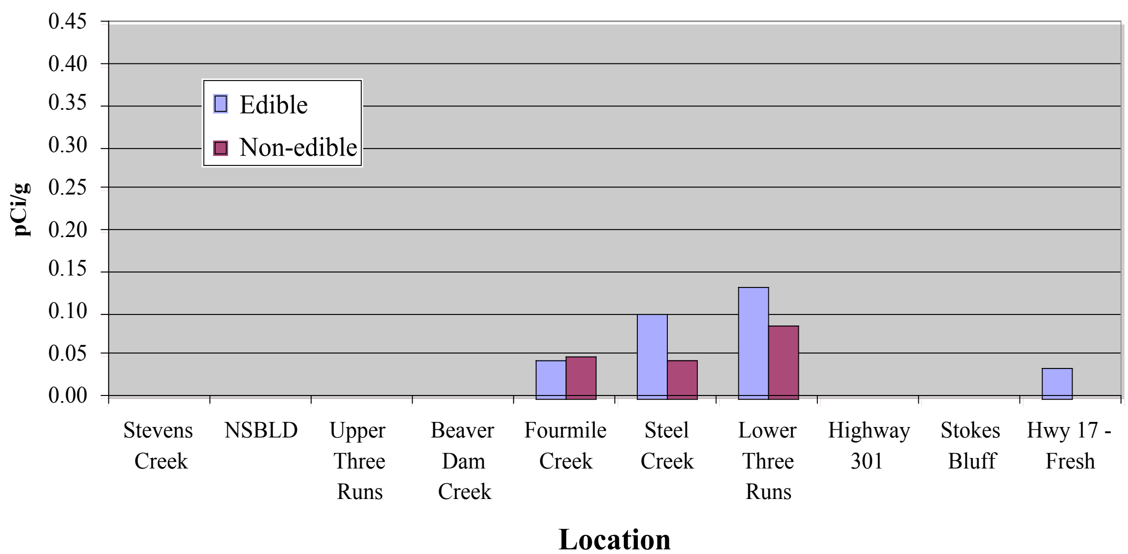
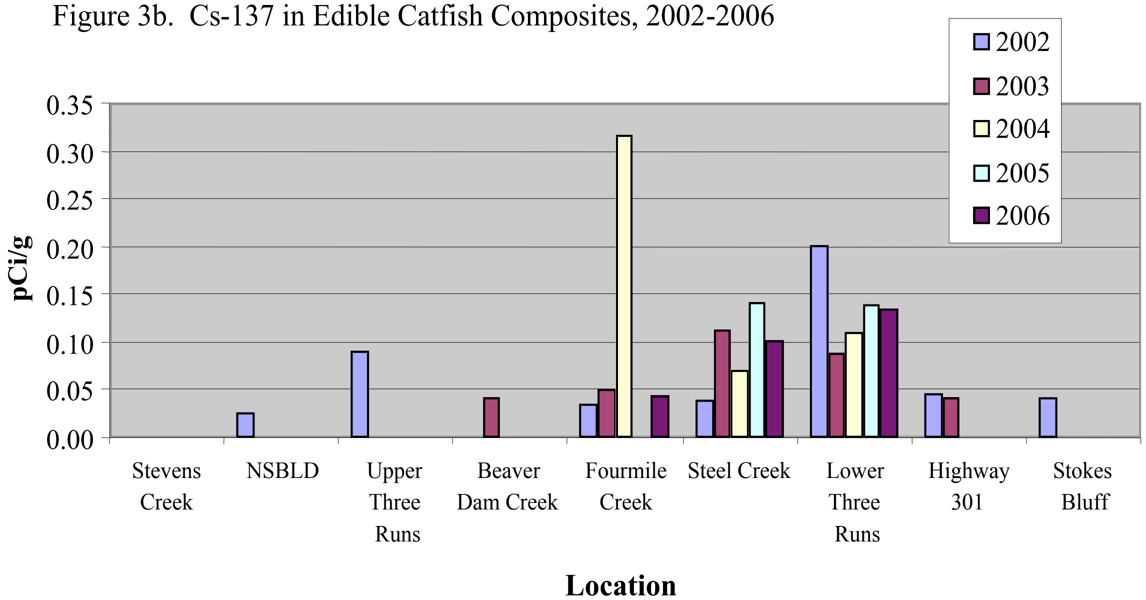



Figure 3b. Cs-137 in Edible Catfish Composites, 2002-2006

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## Tables and Figures
## Radiological Fish Monitoring

Figure 3c. Cs-137 in Non-edible Catfish Composites, 2002-2006

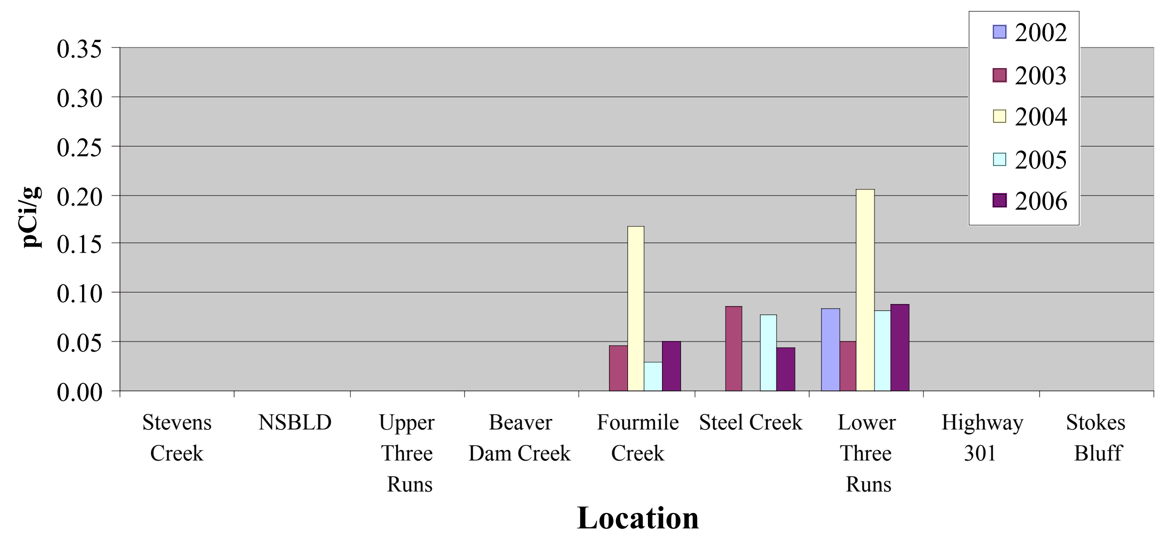
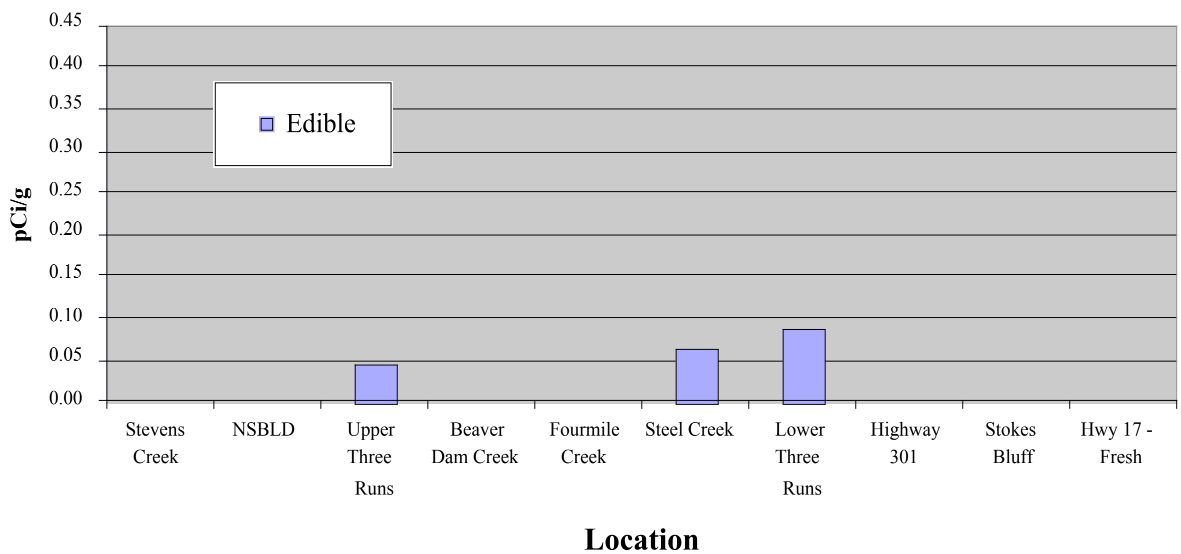



Figure 4. Cesium-137 in Carp Composites, 2006

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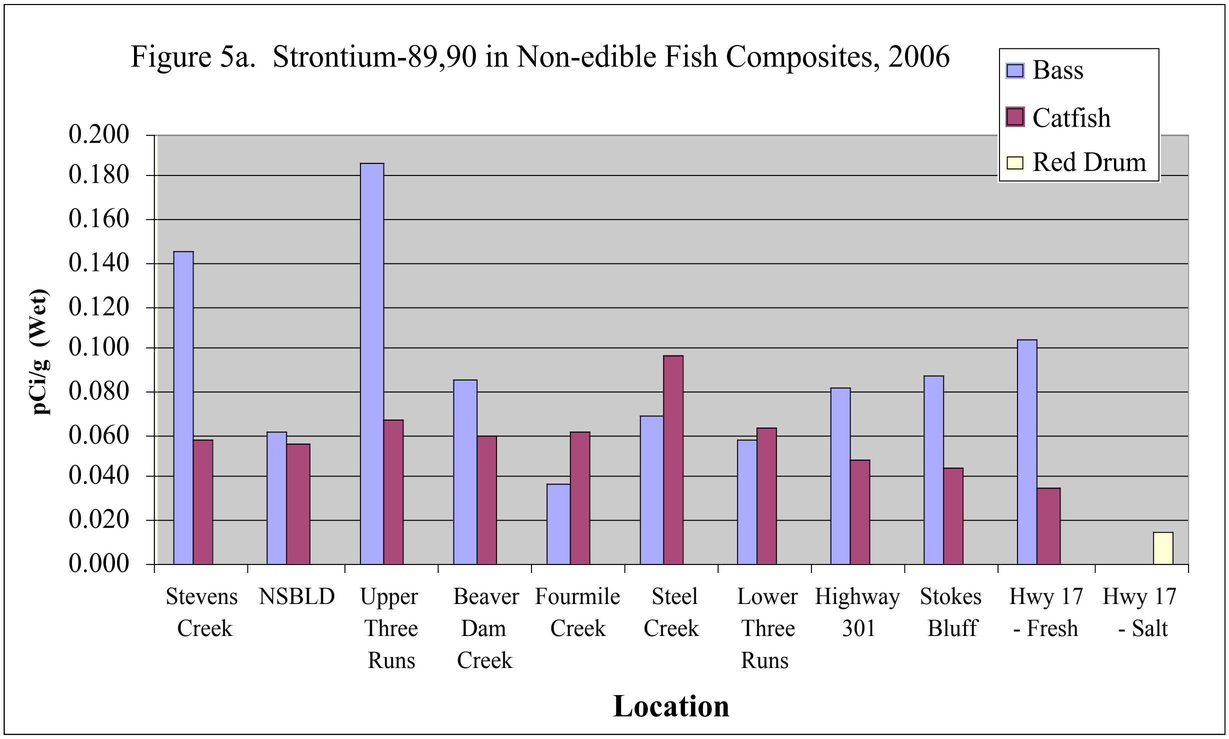
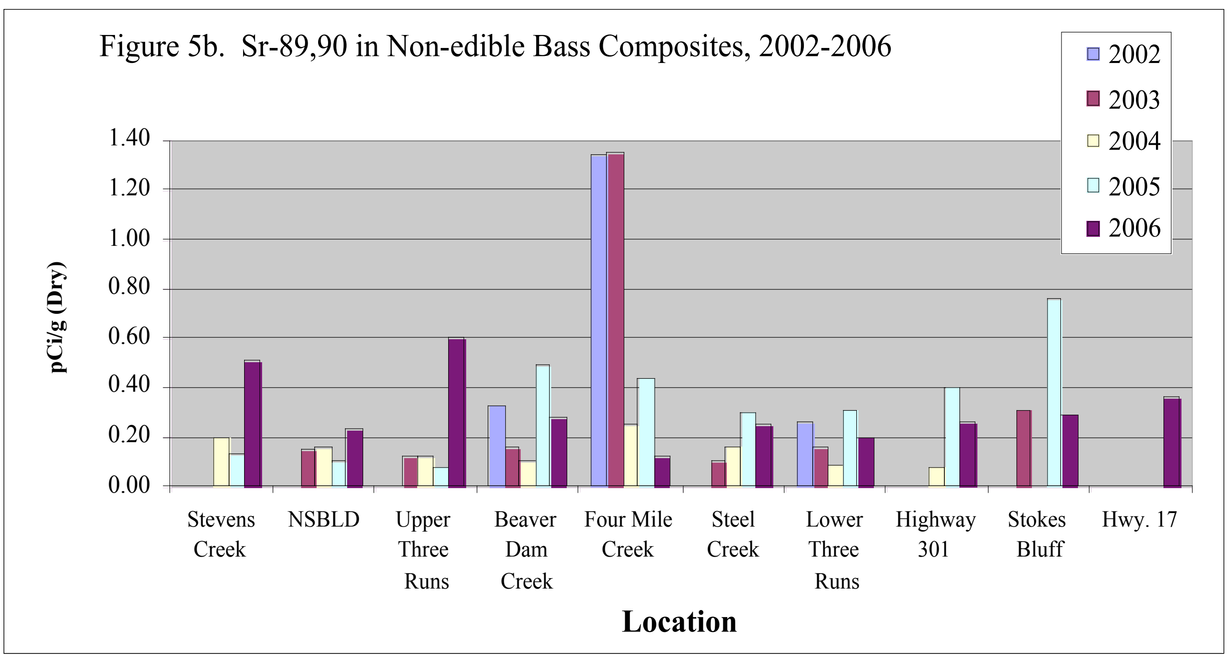
## Tables and Figures
## Radiological Fish Monitoring

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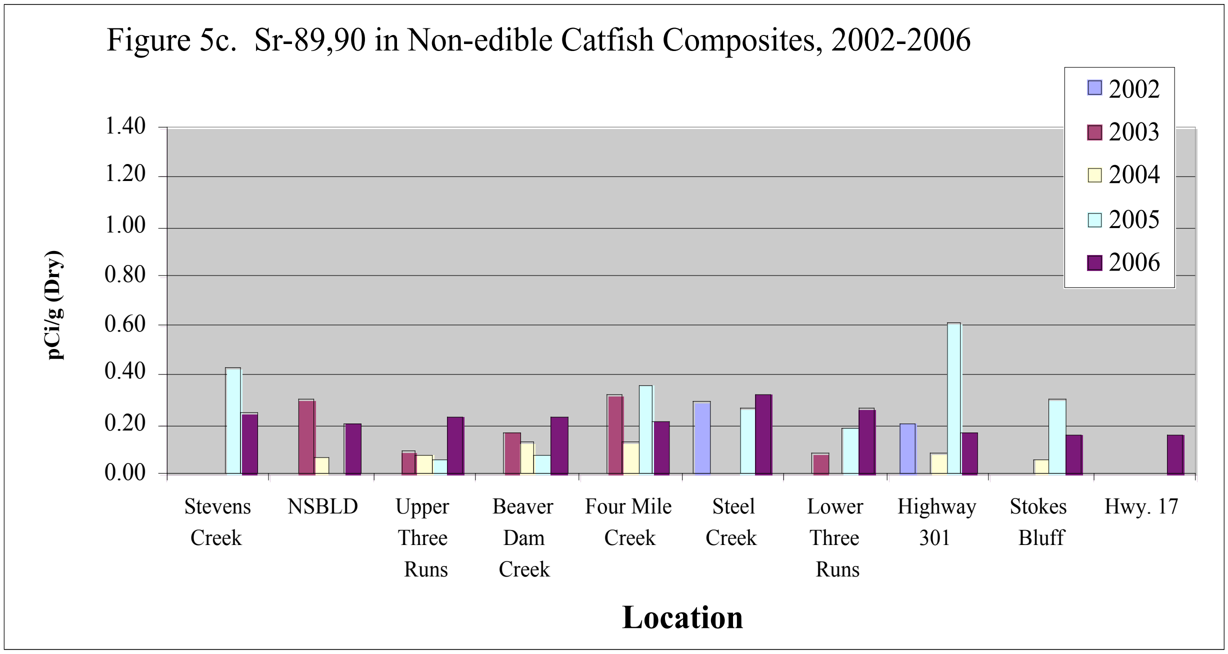
## Tables and Figures
## Radiological Fish Monitoring

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## 4.1.4 Data
## Radiological Monitoring of Fish in the Savannah River



Notes:
1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. LLD - Lower Limit of Detection
5. MDA - Minimum Detectable Activity
6. MDC - Minimum Detectable Concentration
7. Non-detect denotes <LLD or <MDA or <MDC

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Stevens Creek | Stevens Creek | Stevens Creek |
| **Sample Station** | | SV-2059 | SV-2059 | SV-2059 |
| **Sample Date** | | 4/25/2006 | 4/25/2006 | 4/25/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 504 | Not Analyzed | 397 |
| | +/- 2 Sigma | 102 | | 98 |
| | LLD | 195 | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | 0.504 | | 0.397 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | Non-detect |
| | +/- 2 Sigma | | | |
| | MDA | 0.020 | 0.019 | 0.019 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.146 | Not Analyzed |
| | +/- 2 Sigma | | 0.014 | |
| | MDC | | 0.012 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.507 | Not Analyzed |
| | +/- 2 Sigma | | 0.047 | |
| | MDC | | 0.042 | |

Only one channel catfish collected

| | | |
|---|---|---|
| **Sample Location** | | Stevens Creek |
| **Sample Station** | | SV-2059 |
| **Sample Date** | | 4/25/2006 |
| **Sample Cut** | | Non-edible |
| **Species** | | Catfish |
| | Tritium (pCi/L) | Not Analyzed |
| | +/- 2 Sigma | |
| | LLD | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect |
| | +/- 2 Sigma | |
| | MDA | 0.018 |
| | Sr-89/90 **(Wet)** | 0.059 |
| | +/- 2 Sigma | 0.008 |
| | MDC | 0.009 |
| | Sr-89/90 **(Dry)** | 0.247 |
| | +/- 2 Sigma | 0.029 |
| | MDC | 0.036 |

No carp collected

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | NSBLD | NSBLD | NSBLD |
| **Sample Station** | | SV-2028 | SV-2028 | SV-2028 |
| **Sample Date** | | 4/12/2006 | 4/12/2006 | 4/12/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 269 | Not Analyzed | 302 |
| | +/- 2 Sigma | 92 | | 93 |
| | LLD | 191 | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | 0.269 | | 0.302 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | Non-detect |
| | +/- 2 Sigma | | | |
| | MDA | 0.019 | 0.018 | 0.022 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.063 | Not Analyzed |
| | +/- 2 Sigma | | 0.005 | |
| | MDC | | 0.002 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.229 | Not Analyzed |
| | +/- 2 Sigma | | 0.018 | |
| | MDC | | 0.008 | |

NSBLD - New Savannah Bluff Lock & Dam

| | | | |
|---|---|---|---|
| **Sample Location** | | NSBLD | NSBLD |
| **Sample Station** | | SV-2028 | SV-2028 |
| **Sample Date** | | 4/12/2006 | 5/31/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 188 |
| | +/- 2 Sigma | | 86 |
| | LLD | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.188 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.021 | 0.019 |
| | Sr-89/90 **(Wet)** | 0.056 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.003 | |
| | Sr-89/90 **(Dry)** | 0.208 | Not Analyzed |
| | +/- 2 Sigma | 0.017 | |
| | MDC | 0.010 | |

NSBLD - New Savannah Bluff Lock & Dam

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Upper Three Runs | Upper Three Runs | Upper Three Runs |
| **Sample Station** | | SV-2011 | SV-2011 | SV-2011 |
| **Sample Date** | | 4/14/2006 | 4/14/2006 | 4/14/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 385 | Not Analyzed | Non-detect |
| | +/- 2 Sigma | 97 | | |
| | LLD | 191 | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | 0.385 | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | Non-detect |
| | +/- 2 Sigma | | | |
| | MDA | 0.022 | 0.017 | 0.021 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.187 | Not Analyzed |
| | +/- 2 Sigma | | 0.013 | |
| | MDC | | 0.005 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.603 | Not Analyzed |
| | +/- 2 Sigma | | 0.047 | |
| | MDC | | 0.016 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Upper Three Runs | Upper Three Runs |
| **Sample Station** | | SV-2011 | SV-2011 |
| **Sample Date** | | 4/14/2006 | 4/14/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 566 |
| | +/- 2 Sigma | | 103 |
| | LLD | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.566 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | 0.048 |
| | +/- 2 Sigma | | 0.018 |
| | MDA | 0.021 | 0.020 |
| | Sr-89/90 **(Wet)** | 0.067 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.002 | |
| | Sr-89/90 **(Dry)** | 0.234 | Not Analyzed |
| | +/- 2 Sigma | 0.019 | |
| | MDC | 0.008 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Beaver Dam Creek | Beaver Dam Creek | Beaver Dam Creek |
| **Sample Station** | | SV-2013 | SV-2013 | SV-2013 |
| **Sample Date** | | 4/13/2006 | 4/13/2006 | 4/13/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 232 | Not Analyzed | 469 |
| | +/- 2 Sigma | 90 | | 99 |
| | LLD | 191 | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | 0.232 | | 0.469 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | 0.069 | Non-detect | Non-detect |
| | +/- 2 Sigma | 0.031 | | |
| | MDA | 0.023 | 0.017 | 0.022 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.087 | Not Analyzed |
| | +/- 2 Sigma | | 0.006 | |
| | MDC | | 0.003 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.277 | Not Analyzed |
| | +/- 2 Sigma | | 0.022 | |
| | MDC | | 0.009 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Beaver Dam Creek | Beaver Dam Creek |
| **Sample Station** | | SV-2013 | SV-2013 |
| **Sample Date** | | 4/13/2006 | 4/13/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 358 |
| | +/- 2 Sigma | | 95 |
| | LLD | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.358 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.019 | 0.023 |
| | Sr-89/90 **(Wet)** | 0.061 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.003 | |
| | Sr-89/90 **(Dry)** | 0.234 | Not Analyzed |
| | +/- 2 Sigma | 0.019 | |
| | MDC | 0.011 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Fourmile Creek | Fourmile Creek | Fourmile Creek |
| **Sample Station** | | SV-2015 | SV-2015 | SV-2015 |
| **Sample Date** | | 4/17/2006 | 4/17/2006 | 4/17/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 2920 | Not Analyzed | 1779 |
| | +/- 2 Sigma | 168 | | 141 |
| | LLD | 191 | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | 2.92 | | 1.779 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | 0.206 | 0.107 | 0.043 |
| | +/- 2 Sigma | 0.033 | 0.030 | 0.019 |
| | MDA | 0.016 | 0.019 | 0.016 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.038 | Not Analyzed |
| | +/- 2 Sigma | | 0.003 | |
| | MDC | | 0.003 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.116 | Not Analyzed |
| | +/- 2 Sigma | | 0.011 | |
| | MDC | | 0.010 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Fourmile Creek | Fourmile Creek |
| **Sample Station** | | SV-2015 | SV-2015 |
| **Sample Date** | | 4/17/2006 | 4/17/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 1335 |
| | +/- 2 Sigma | | 128 |
| | LLD | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | | 1.335 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | 0.051 | Non-detect |
| | +/- 2 Sigma | 0.023 | |
| | MDA | 0.019 | 0.017 |
| | Sr-89/90 **(Wet)** | 0.063 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.002 | |
| | Sr-89/90 **(Dry)** | 0.213 | Not Analyzed |
| | +/- 2 Sigma | 0.017 | |
| | MDC | 0.008 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Steel Creek | Steel Creek | Steel Creek |
| **Sample Station** | | SV-2017 | SV-2017 | SV-2017 |
| **Sample Date** | | 4/11/2006 | 4/11/2006 | 4/11/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 2287 | Not Analyzed | 2104 |
| | +/- 2 Sigma | 154 | | 149 |
| | LLD | 191 | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | 2.287 | | 2.104 |
| Radionuclides | Cs-137 **(Wet)** | 0.198 | 0.081 | 0.101 |
| (pCi/g ) | +/- 2 Sigma | 0.036 | 0.254 | 0.027 |
| | MDA | 0.018 | 0.018 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.070 | Not Analyzed |
| | +/- 2 Sigma | | 0.005 | |
| | MDC | | 0.002 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.248 | Not Analyzed |
| | +/- 2 Sigma | | 0.020 | |
| | MDC | | 0.008 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Steel Creek | Steel Creek |
| **Sample Station** | | SV-2017 | SV-2017 |
| **Sample Date** | | 4/11/2006 | 4/11/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 2879 |
| | +/- 2 Sigma | | 168 |
| | LLD | | 191 |
| **Tritium (pCi)/gram of water in tissue** | | | 2.879 |
| Radionuclides | Cs-137 **(Wet)** | 0.045 | 0.063 |
| (pCi/g ) | +/- 2 Sigma | 0.022 | 0.019 |
| | MDA | 0.016 | 0.018 |
| | Sr-89/90 **(Wet)** | 0.097 | Not Analyzed |
| | +/- 2 Sigma | 0.007 | |
| | MDC | 0.003 | |
| | Sr-89/90 **(Dry)** | 0.329 | Not Analyzed |
| | +/- 2 Sigma | 0.026 | |
| | MDC | 0.009 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| **Sample Location** | | Lower Three Runs | Lower Three Runs | Lower Three Runs |
|---|---|---|---|---|
| **Sample Station** | | SV-2020 | SV-2020 | SV-2020 |
| **Sample Date** | | 4/19/2006 | 4/19/2006 | 4/19/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 474 | Not Analyzed | 451 |
| | +/- 2 Sigma | 101 | | 101 |
| | LLD | 195 | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | 0.474 | | 0.451 |
| Radionuclides | Cs-137 **(Wet)** | 0.391 | 0.192 | 0.135 |
| (pCi/g ) | +/- 2 Sigma | 0.050 | 0.031 | 0.034 |
| | MDA | 0.017 | 0.017 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.059 | Not Analyzed |
| | +/- 2 Sigma | | 0.006 | |
| | MDC | | 0.007 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.196 | Not Analyzed |
| | +/- 2 Sigma | | 0.021 | |
| | MDC | | 0.023 | |

| **Sample Location** | | Lower Three Runs | Lower Three Runs |
|---|---|---|---|
| **Sample Station** | | SV-2020 | SV-2020 |
| **Sample Date** | | 4/19/2006 | 4/19/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 619 |
| | +/- 2 Sigma | | 102 |
| | LLD | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.619 |
| Radionuclides | Cs-137 **(Wet)** | 0.088 | 0.088 |
| (pCi/g ) | +/- 2 Sigma | 0.022 | 0.024 |
| | MDA | 0.018 | 0.017 |
| | Sr-89/90 **(Wet)** | 0.065 | Not Analyzed |
| | +/- 2 Sigma | 0.008 | |
| | MDC | 0.008 | |
| | Sr-89/90 **(Dry)** | 0.266 | Not Analyzed |
| | +/- 2 Sigma | 0.028 | |
| | MDC | 0.031 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Hwy. 301 | Hwy. 301 | Hwy. 301 |
| **Sample Station** | | SV-118 | SV-118 | SV-118 |
| **Sample Date** | | 4/18/2006 | 4/18/2006 | 4/18/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 454 | Not Analyzed | 423 |
| | +/- 2 Sigma | 101 | | 99 |
| | LLD | 195 | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | 0.454 | | 0.423 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | Non-detect |
| | +/- 2 Sigma | | | |
| | MDA | 0.017 | 0.019 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.082 | Not Analyzed |
| | +/- 2 Sigma | | 0.006 | |
| | MDC | | 0.002 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.258 | Not Analyzed |
| | +/- 2 Sigma | | 0.020 | |
| | MDC | | 0.008 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Hwy. 301 | Hwy. 301 |
| **Sample Station** | | SV-118 | SV-118 |
| **Sample Date** | | 4/18/2006 | 4/18/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 400 |
| | +/- 2 Sigma | | 98 |
| | LLD | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.400 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.019 | 0.018 |
| | Sr-89/90 **(Wet)** | 0.048 | Not Analyzed |
| | +/- 2 Sigma | 0.004 | |
| | MDC | 0.002 | |
| | Sr-89/90 **(Dry)** | 0.168 | Not Analyzed |
| | +/- 2 Sigma | 0.014 | |
| | MDC | 0.007 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Stokes Bluff | Stokes Bluff | Stokes Bluff |
| **Sample Station** | | SV-355 | SV-355 | SV-355 |
| **Sample Date** | | 4/27/2006 | 4/27/2006 | 4/27/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 265 | Not Analyzed | 296 |
| | +/- 2 Sigma | 93 | | 94 |
| | LLD | 195 | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | 0.265 | | 0.296 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | 0.039 | Non-detect | Non-detect |
| | +/- 2 Sigma | 0.017 | | |
| | MDA | 0.017 | 0.020 | 0.017 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.088 | Not Analyzed |
| | +/- 2 Sigma | | 0.008 | |
| | MDC | | 0.008 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.296 | Not Analyzed |
| | +/- 2 Sigma | | 0.028 | |
| | MDC | | 0.028 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Stokes Bluff | Stokes Bluff |
| **Sample Station** | | SV-355 | SV-355 |
| **Sample Date** | | 4/27/2006 | 4/27/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 218 |
| | +/- 2 Sigma | | 86 |
| | LLD | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.218 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.020 | 0.020 |
| | Sr-89/90 **(Wet)** | 0.046 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.007 | |
| | Sr-89/90 **(Dry)** | 0.165 | Not Analyzed |
| | +/- 2 Sigma | 0.019 | |
| | MDC | 0.024 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Hwy. 17 - Fresh | Hwy. 17 - Fresh | Hwy. 17 - Fresh |
| **Sample Station** | | SV-2090 | SV-2090 | SV-2090 |
| **Sample Date** | | 7/19/2006 | 7/19/2006 | 7/19/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Bass | Bass | Catfish |
| | Tritium (pCi/L) | 368 | Not Analyzed | Non-detect |
| | +/- 2 Sigma | 98 | | |
| | LLD | 195 | | 195 |
| **Tritium (pCi)/gram of water in tissue** | | 0.368 | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | 0.035 |
| | +/- 2 Sigma | | | 0.015 |
| | MDA | 0.017 | 0.016 | 0.018 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.105 | Not Analyzed |
| | +/- 2 Sigma | | 0.010 | |
| | MDC | | 0.009 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.357 | Not Analyzed |
| | +/- 2 Sigma | | 0.033 | |
| | MDC | | 0.030 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Hwy. 17 - Fresh | Hwy. 17 - Fresh |
| **Sample Station** | | SV-2090 | SV-2090 |
| **Sample Date** | | 7/19/2006 | 7/19/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Catfish | Common carp |
| | Tritium (pCi/L) | Not Analyzed | 721 |
| | +/- 2 Sigma | | 106 |
| | LLD | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.721 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.021 | 0.016 |
| | Sr-89/90 **(Wet)** | 0.036 | Not Analyzed |
| | +/- 2 Sigma | 0.005 | |
| | MDC | 0.004 | |
| | Sr-89/90 **(Dry)** | 0.166 | Not Analyzed |
| | +/- 2 Sigma | 0.017 | |
| | MDC | 0.017 | |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | Hwy. 17 - Salt | Hwy. 17 - Salt | Hwy. 17 - Salt |
| **Sample Station** | | SV-2091 | SV-2091 | SV-2091 |
| **Sample Date** | | 10/31/2006 | 10/31/2006 | 10/31/2006 |
| **Sample Cut** | | Edible | Non-edible | Edible |
| **Species** | | Red drum | Red drum | Spotted seatrout |
| | Tritium (pCi/L) | 223 | Not Analyzed | 296 |
| | +/- 2 Sigma | 104 | | 106 |
| | LLD | 182 | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | 0.223 | | 0.296 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect | Non-detect |
| | +/- 2 Sigma | | | |
| | MDA | 0.017 | 0.021 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.015 | Not Analyzed |
| | +/- 2 Sigma | | 0.004 | |
| | MDC | | 0.007 | |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.061 | Not Analyzed |
| | +/- 2 Sigma | | 0.018 | |
| | MDC | | 0.027 | |

| | | | |
|---|---|---|---|
| **Sample Location** | | Hwy. 17 - Salt | Hwy. 17 - Salt |
| **Sample Station** | | SV-2091 | SV-2091 |
| **Sample Date** | | 10/31/2006 | 10/31/2006 |
| **Sample Cut** | | Non-edible | Edible |
| **Species** | | Spotted seatrout | Striped mullet |
| | Tritium (pCi/L) | Not Analyzed | 303 |
| | +/- 2 Sigma | | 104 |
| | LLD | | 182 |
| **Tritium (pCi)/gram of water in tissue** | | | 0.303 |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.020 | 0.021 |
| | Sr-89/90 **(Wet)** | 0.002 | Not Analyzed |
| | +/- 2 Sigma | 0.002 | |
| | MDC | 0.004 | |
| | Sr-89/90 **(Dry)** | Non-detect | Not Analyzed |
| | +/- 2 Sigma | | |
| | MDC | 0.017 | |

**Back to List of Data Tables**

## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | | |
|---|---|---|---|---|
| **Sample Location** | | FMC - Individual | Stokes - Ind. | Stokes - Ind. |
| **Sample Station** | | SV-2015 | SV-355 | SV-355 |
| **Sample Date** | | 4/17/2006 | 4/27/2006 | 4/27/2006 |
| **Sample Cut** | | Edible | Edible | Non-edible |
| **Species** | | Bass | Catfish | Catfish |
| | Tritium (pCi/L) | 2421 | Not Analyzed | Not Analyzed |
| | +/- 2 Sigma | 157 | | |
| | LLD | 191 | | |
| **Tritium (pCi)/gram of water in tissue** | | 2.421 | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | 0.591 | Non-detect | Non-detect |
| | +/- 2 Sigma | 0.075 | | |
| | MDA | 0.023 | 0.017 | 0.016 |
| | Sr-89/90 **(Wet)** | Not Analyzed | Not Analyzed | Not Analyzed |
| | +/- 2 Sigma | | | |
| | MDC | | | |
| | Sr-89/90 **(Dry)** | Not Analyzed | Not Analyzed | Not Analyzed |
| | +/- 2 Sigma | | | |
| | MDC | | | |

FMC - Fourmile Creek
Stokes - Stokes Bluff

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | |
|---|---|---|---|
| **Sample Location** | | Broad River | Broad River |
| **Sample Station** | | B5 | B5 |
| **Sample Date** | | 6/13/2006 | 6/13/2006 |
| **Sample Cut** | | Edible | Non-edible |
| **Species** | | Bass | Bass |
| | Tritium (pCi/L) | <182 | Not Analyzed |
| | +/- 2 Sigma | | |
| | LLD | | |
| **Tritium (pCi)/gram of water in tissue** | | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.018 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.044 |
| | +/- 2 Sigma | | 0.007 |
| | MDC | | 0.009 |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.164 |
| | +/- 2 Sigma | | 0.026 |
| | MDC | | 0.036 |

| | | | |
|---|---|---|---|
| **Sample Location** | | Broad River | Broad River |
| **Sample Station** | | B5 | B5 |
| **Sample Date** | | 6/13/2006 | 6/13/2006 |
| **Sample Cut** | | Edible | Non-edible |
| **Species** | | Catfish | Catfish |
| | Tritium (pCi/L) | <182 | Not Analyzed |
| | +/- 2 Sigma | | |
| | LLD | | |
| **Tritium (pCi)/gram of water in tissue** | | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.017 | 0.020 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.030 |
| | +/- 2 Sigma | | 0.004 |
| | MDC | | 0.006 |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.151 |
| | +/- 2 Sigma | | 0.022 |
| | MDC | | 0.029 |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | |
|---|---|---|---|
| **Sample Location** | | Secession Lake | Secession Lake |
| **Sample Station** | | B6 | B6 |
| **Sample Date** | | 6/20/2006 | 6/20/2006 |
| **Sample Cut** | | Edible | Non-edible |
| **Species** | | Bass | Bass |
| | Tritium (pCi/L) | <182 | Not Analyzed |
| | +/- 2 Sigma | | |
| | LLD | | |
| **Tritium (pCi)/gram of water in tissue** | | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.017 | 0.019 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.046 |
| | +/- 2 Sigma | | 0.007 |
| | MDC | | 0.010 |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.137 |
| | +/- 2 Sigma | | 0.022 |
| | MDC | | 0.030 |

| | | | |
|---|---|---|---|
| **Sample Location** | | Secession Lake | Secession Lake |
| **Sample Station** | | B6 | B6 |
| **Sample Date** | | 6/20/2006 | 6/20/2006 |
| **Sample Cut** | | Edible | Non-edible |
| **Species** | | Catfish | Catfish |
| | Tritium (pCi/L) | <182 | Not Analyzed |
| | +/- 2 Sigma | | |
| | LLD | | |
| **Tritium (pCi)/gram of water in tissue** | | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.021 | 0.023 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.029 |
| | +/- 2 Sigma | | 0.004 |
| | MDC | | 0.005 |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.107 |
| | +/- 2 Sigma | | 0.015 |
| | MDC | | 0.020 |

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## Radiological Monitoring of Fish Data
## Radionuclides Data

| | | | |
|---|---|---|---|
| **Sample Location** | | Lake Brown | Lake Brown |
| **Sample Station** | | E2 | E2 |
| **Sample Date** | | 10/26/2006 | 10/26/2006 |
| **Sample Cut** | | Edible | Non-edible |
| **Species** | | Bass | Bass |
| | Tritium (pCi/L) | <182 | Not Analyzed |
| | +/- 2 Sigma | | |
| | LLD | | |
| **Tritium (pCi)/gram of water in tissue** | | | |
| Radionuclides (pCi/g ) | Cs-137 **(Wet)** | Non-detect | Non-detect |
| | +/- 2 Sigma | | |
| | MDA | 0.020 | 0.018 |
| | Sr-89/90 **(Wet)** | Not Analyzed | 0.031 |
| | +/- 2 Sigma | | 0.006 |
| | MDC | | 0.009 |
| | Sr-89/90 **(Dry)** | Not Analyzed | 0.115 |
| | +/- 2 Sigma | | 0.023 |
| | MDC | | 0.033 |

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## Radiological Monitoring of Fish Data
## ESOP Historical Data, 2002-2006

| Year | Sample Location | | Stevens | NSBLD | UTR | BDC | FMC | STC | LTR | Hwy. 301 | Stokes | Hwy. 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample Station** | | SV-2059 | SV-2028 | SV-2011 | SV-2013 | SV-2015 | SV-2017 | SV-2020 | SV-118 | SV-355 | SV-2090 |
| | **Sample Cut** | | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible |
| | **Species** | | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass |
| 2006 | Radionuclide | Tritium (pCi/L) | 504 | 269 | 385 | 232 | 2920 | 2287 | 474 | 454 | 265 | 368 |
| 2005 | | | ND | ND | ND | ND | 2572 | 836 | 403 | 257 | ND | NS |
| 2004 | | | ND | ND | ND | ND | 2,865 | 3,442 | 526 | 2,425 | 227 | NS |
| 2003 | | | ND | ND | 292 | 292 | 2,621 | 888 | 666 | 705 | 508 | NS |
| 2002 | | | ND | **332** | **524** | **718** | 6,801 | 1,637 | ND | **763** | 1,348 | NS |
| 2006 | Radionuclide | Cs-137 (pCi/g wet) | ND | ND | ND | 0.07 | 0.21 | 0.20 | 0.39 | ND | 0.04 | ND |
| 2005 | | | ND | ND | 0.14 | 0.10 | 0.55 | 0.18 | 0.18 | 0.05 | ND | NS |
| 2004 | | | ND | ND | 0.06 | 0.08 | 0.09 | 0.23 | 0.57 | ND | 0.06 | NS |
| 2003 | | | ND | 0.05 | 0.04 | 0.05 | 0.37 | 0.15 | 0.06 | 0.07 | 0.06 | NS |
| 2002 | | | ND | 0.04 | 0.05 | 0.16 | 0.22 | 0.26 | 0.72 | 0.06 | 0.06 | NS |

| Year | Sample Location | | Stevens | NSBLD | UTR | BDC | FMC | STC | LTR | Hwy. 301 | Stokes | Hwy. 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample Station** | | SV-2059 | SV-2028 | SV-2011 | SV-2013 | SV-2015 | SV-2017 | SV-2020 | SV-118 | SV-355 | SV-2090 |
| | **Sample Cut** | | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible |
| | **Species** | | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass | Bass |
| 2006 | Radionuclide | Cs-137 (pCi/g wet) | ND | ND | ND | ND | 0.11 | 0.08 | 0.19 | ND | ND | ND |
| 2005 | | | ND | ND | 0.08 | 0.04 | 0.31 | 0.11 | 0.12 | ND | ND | NS |
| 2004 | | | ND | ND | ND | 0.04 | 0.06 | 0.17 | 0.28 | ND | ND | NS |
| 2003 | | | ND | ND | ND | 0.03 | 0.16 | 0.11 | 0.03 | ND | ND | NS |
| 2002 | | | ND | ND | 0.04 | 0.06 | 0.15 | 0.13 | 0.40 | ND | ND | NS |
| 2006 | Radionuclide | Sr-89,90 (pCi/g dry) | 0.51 | 0.23 | 0.60 | 0.28 | 0.12 | 0.25 | 0.20 | 0.26 | 0.30 | 0.357 |
| 2005 | | | 0.13 | 0.10 | 0.08 | 0.49 | 0.44 | 0.30 | 0.31 | 0.40 | 0.75 | NS |
| 2004 | | | 0.20 | 0.16 | 0.12 | 0.10 | 0.25 | 0.17 | 0.09 | 0.08 | ND | NS |
| 2003 | | | NA | 0.15 | 0.12 | 0.16 | 1.35 | 0.10 | 0.16 | ND | 0.31 | NS |
| 2002 | | | NA | NA | ND | 0.33 | 1.34 | NA | 0.26 | ND | NA | NS |

Notes: ND - Non-Detect
NA - Not Analyzed
NS - Not Sampled

**Bold** denotes failed laboratory QA

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## Radiological Monitoring of Fish Data
## ESOP Historical Data, 2002-2006

| Year | Sample Location | | Stevens | NSBLD | UTR | BDC | FMC | STC | LTR | Hwy. 301 | Stokes | Hwy. 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample Station** | | SV-2059 | SV-2028 | SV-2011 | SV-2013 | SV-2015 | SV-2017 | SV-2020 | SV-118 | SV-355 | SV-2090 |
| | **Sample Cut** | | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible | Edible |
| | **Species** | | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish |
| 2006 | Radionuclide | Tritium (pCi/L) | 397 | 302 | ND | 469 | 1779 | 2104 | 451 | 423.00 | 296.00 | ND |
| 2005 | | | ND | ND | ND | ND | 669 | 340 | 362 | ND | ND | NS |
| 2004 | | | ND | ND | 377 | 282 | 3761 | 295 | 315 | 2042 | 228 | NS |
| 2003 | | | ND | 209 | ND | 277 | 388 | 583 | 537 | ND | 354 | NS |
| 2002 | | | ND | ND | ND | 271 | 931 | 890 | ND | 1150 | 621 | NS |
| 2006 | Radionuclide | Cs-137 (pCi/g wet) | ND | ND | ND | ND | 0.04 | 0.10 | 0.14 | ND | ND | 0.035 |
| 2005 | | | ND | ND | ND | ND | ND | 0.14 | 0.14 | ND | ND | NS |
| 2004 | | | ND | ND | ND | ND | 0.32 | 0.07 | 0.11 | ND | ND | NS |
| 2003 | | | ND | ND | ND | 0.04 | 0.05 | 0.11 | 0.09 | 0.04 | ND | NS |
| 2002 | | | ND | 0.03 | 0.09 | ND | 0.04 | 0.04 | 0.20 | 0.05 | 0.04 | NS |

| Year | Sample Location | | Stevens | NSBLD | UTR | BDC | FMC | STC | LTR | Hwy. 301 | Stokes | Hwy. 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample Station** | | SV-2059 | SV-2028 | SV-2011 | SV-2013 | SV-2015 | SV-2017 | SV-2020 | SV-118 | SV-355 | SV-2090 |
| | **Sample Cut** | | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible | Non-Edible |
| | **Species** | | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish | Catfish |
| 2006 | Radionuclide | Cs-137 (pCi/g wet) | ND | ND | ND | ND | 0.05 | 0.05 | 0.09 | ND | ND | ND |
| 2005 | | | ND | ND | ND | ND | 0.03 | 0.08 | 0.08 | ND | ND | NS |
| 2004 | | | ND | ND | ND | ND | 0.17 | ND | 0.21 | ND | ND | NS |
| 2003 | | | ND | ND | ND | ND | 0.05 | 0.09 | 0.05 | ND | ND | NS |
| 2002 | | | ND | ND | ND | ND | ND | ND | 0.08 | ND | ND | NS |
| 2006 | Radionuclide | Sr-90 (pCi/g dry) | 0.25 | 0.21 | 0.23 | 0.23 | 0.21 | 0.33 | 0.27 | 0.17 | 0.17 | 0.166 |
| 2005 | | | 0.43 | ND | 0.06 | 0.08 | 0.36 | 0.26 | 0.19 | 0.61 | 0.30 | NS |
| 2004 | | | NA | 0.07 | 0.08 | 0.13 | 0.13 | ND | ND | 0.08 | 0.06 | NS |
| 2003 | | | NA | 0.302 | 0.0976 | 0.173 | 0.32 | ND | 0.09 | ND | ND | NS |
| 2002 | | | NA | NA | ND | ND | ND | 0.30 | ND | 0.21 | NA | NS |

Notes: ND - Non-Detect
NA - Not Analyzed
NS - Not Sampled

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## Radiological Monitoring of Fish Data
## ESOP and DOE-SR Data Comparison

Tritium Activity Levels in Edible Bass
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | 0.21 |
| | DOE-SR | 3 | 0.12 |
| | | | |
| UTR | ESOP | 1 | 0.30 |
| | DOE-SR | 3 | <MDC |
| | | | |
| BDC | ESOP | 1 | 0.18 |
| | DOE-SR | 3 | 0.07** |
| | | | |
| FMC | ESOP | 1 | 2.31 |
| | DOE-SR | 3 | <MDC |
| | | | |
| STC | ESOP | 1 | 1.81 |
| | DOE-SR | 3 | 0.23* |
| | | | |
| LTR | ESOP | 1 | 0.37 |
| | DOE-SR | 3 | 0.11* |
| | | | |
| Hwy. 301 | ESOP | 1 | 0.36 |
| | DOE-SR | 3 | <MDC |
| | | | |
| STOKES | ESOP | 1 | 0.21 |
| | DOE-SR | 3 | 0.10* |
| | | | |
| Hwy. 17 | ESOP | 1 | 0.29 |
| | DOE-SR | 3 | <MDC |
| Average | ESOP | 9 | 0.67 |
| | DOE-SR | 10 | 0.16 |
| Standard Deviation | ESOP | 9 | 0.80 |
| | DOE-SR | 10 | 0.09 |

Tritium Activity Levels in Edible Catfish
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | 0.24 |
| | DOE-SR | 3 | <MDC |
| | | | |
| UTR | ESOP | 1 | <LLD |
| | DOE-SR | 3 | <MDC |
| | | | |
| BDC | ESOP | 1 | 0.37 |
| | DOE-SR | 3 | <MDC |
| | | | |
| FMC | ESOP | 1 | 1.41 |
| | DOE-SR | 3 | <MDC |
| | | | |
| STC | ESOP | 1 | 1.66 |
| | DOE-SR | 3 | <MDC |
| | | | |
| LTR | ESOP | 1 | 0.36 |
| | DOE-SR | 3 | 0.16** |
| | | | |
| Hwy. 301 | ESOP | 1 | 0.33 |
| | DOE-SR | 3 | <MDC |
| | | | |
| STOKES | ESOP | 1 | 0.23 |
| | DOE-SR | 3 | <MDC |
| | | | |
| Hwy. 17 | ESOP | 1 | <LLD |
| | DOE-SR | 3 | <MDC |
| Average | ESOP | 7 | 0.66 |
| | DOE-SR | 1 | NA |
| Standard Deviation | ESOP | 7 | 0.61 |
| | DOE-SR | 1 | NA |

Notes:
NSBLD = New Savannah Bluff Lock and Dam
UTR = Upper Three Runs
BDC = Beaver Dam Creek
FMC = Four Mile Creek
STC = Steel Creek
LTR = Lower Three Runs
Hwy. 301 = Savannah River at U.S. Hwy. 301
MDA = Minimum Detectable Activity
MDC = Minimum Detectable Concentration
DOE-SR data from WSRC 2007
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
Averages calculated using detections only

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## Radiological Monitoring of Fish Data
## ESOP and DOE-SR Data Comparison

Cesium-137 Activity Levels in Edible Bass
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.03** |
| UTR | ESOP | 1 | <MDA |
| | DOE-SR | 3 | 0.03** |
| BDC | ESOP | 1 | 0.07 |
| | DOE-SR | 3 | 0.19 |
| FMC | ESOP | 1 | 0.21 |
| | DOE-SR | 3 | 0.09 |
| STC | ESOP | 1 | 0.20 |
| | DOE-SR | 3 | 0.22 |
| LTR | ESOP | 1 | 0.39 |
| | DOE-SR | 3 | 0.08 |
| Hwy. 301 | ESOP | 1 | <MDA |
| | DOE-SR | 3 | 0.03 |
| STOKES | ESOP | 1 | 0.04 |
| | DOE-SR | 3 | <MDC |
| Hwy. 17 | ESOP | 1 | <MDA |
| | DOE-SR | 3 | 0.05** |
| Average | ESOP | 5 | 0.18 |
| | DOE-SR | 18 | 0.10 |
| Standard Deviation | ESOP | 5 | 0.14 |
| | DOE-SR | 18 | 0.07 |

Cesium-137 Activity Levels in Edible Catfish
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | < MDA |
| | DOE-SR | 3 | <MDC |
| UTR | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.04** |
| BDC | ESOP | 1 | <MDA |
| | DOE-SR | 3 | 0.06* |
| FMC | ESOP | 1 | 0.04 |
| | DOE-SR | 3 | 0.05 |
| STC | ESOP | 1 | 0.10 |
| | DOE-SR | 3 | 0.07** |
| LTR | ESOP | 1 | 0.14 |
| | DOE-SR | 3 | 0.12 |
| Hwy. 301 | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.02** |
| STOKES | ESOP | 1 | <MDA |
| | DOE-SR | 3 | <MDC |
| Hwy. 17 | ESOP | 1 | 0.04 |
| | DOE-SR | 3 | <MDC |
| Average | ESOP | 4 | 0.08 |
| | DOE-SR | 11 | 0.08 |
| Standard Deviation | ESOP | 4 | 0.05 |
| | DOE-SR | 11 | 0.03 |

Notes:
NSBLD = New Savannah Bluff Lock and Dam
UTR = Upper Three Runs
BDC = Beaver Dam Creek
FMC = Four Mile Creek
STC = Steel Creek
LTR = Lower Three Runs
Hwy. 301 = Savannah River at U.S. Hwy. 301
STOKES = Stokes Bluff
Hwy. 17 = Savannah River at U.S. Hwy. 17
MDA = Minimum Detectable Activity
MDC = Minimum Detectable Concentration
DOE-SR data from WSRC 2007
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
Averages calculated using detections only

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## Radiological Monitoring of Fish Data
## ESOP and DOE-SR Data Comparison

Cesium-137 Activity Levels in Non-edible Bass
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | < MDA |
| | DOE-SR | 3 | <MDC |
| UTR | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.05* |
| BDC | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.18 |
| FMC | ESOP | 1 | 0.11 |
| | DOE-SR | 3 | 0.10 |
| STC | ESOP | 1 | 0.08 |
| | DOE-SR | 3 | 0.15 |
| LTR | ESOP | 1 | 0.19 |
| | DOE-SR | 3 | 0.10 |
| Hwy. 301 | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.02 |
| Average | ESOP | 3 | 0.13 |
| | DOE-SR | 17 | 0.10 |
| Standard Deviation | ESOP | 3 | 0.06 |
| | DOE-SR | 17 | 0.06 |

Cesium-137 Activity Levels in Non-edible Catfish
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | < MDA |
| | DOE-SR | 3 | <MDC |
| UTR | ESOP | 1 | < MDA |
| | DOE-SR | 3 | < MDC |
| BDC | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.03** |
| FMC | ESOP | 1 | 0.05 |
| | DOE-SR | 3 | <MDC |
| STC | ESOP | 1 | 0.05 |
| | DOE-SR | 3 | 0.05** |
| LTR | ESOP | 1 | 0.09 |
| | DOE-SR | 3 | 0.07 |
| Hwy. 301 | ESOP | 1 | < MDA |
| | DOE-SR | 3 | 0.02** |
| Average | ESOP | 3 | 0.06 |
| | DOE-SR | 6 | 0.05 |
| Standard Deviation | ESOP | 3 | 0.02 |
| | DOE-SR | 6 | 0.02 |

Notes:
NSBLD = New Savannah Bluff Lock and Dam
UTR = Upper Three Runs
BDC = Beaver Dam Creek
FMC = Four Mile Creek
STC = Steel Creek
LTR = Lower Three Runs
Hwy. 301 = Savannah River at U.S. Hwy. 301
MDA = Minimum Detectable Activity
MDC = Minimum Detectable Concentration
DOE-SR data from WSRC 2007
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
Averages calculated using detections only

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# Radiological Monitoring of Fish Data
# ESOP and DOE-SR Data Comparison

Strontium-**89,90** Activity Levels in Non-edible Bass

pCi/g **( DRY )**

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | 0.23 |
| | DOE-SR | 3 | 0.11 |
| UTR | ESOP | 1 | 0.60 |
| | DOE-SR | 3 | 0.10 |
| BDC | ESOP | 1 | 0.28 |
| | DOE-SR | 3 | 0.44 |
| FMC | ESOP | 1 | 0.12 |
| | DOE-SR | 3 | 0.14 |
| STC | ESOP | 1 | 0.25 |
| | DOE-SR | 3 | 0.13 |
| LTR | ESOP | 1 | 0.20 |
| | DOE-SR | 3 | 0.10 |
| Hwy. 301 | ESOP | 1 | 0.26 |
| | DOE-SR | 3 | 0.05 |
| Average | ESOP | 7 | 0.28 |
| | DOE-SR | 21 | 0.15 |
| Standard Deviation | ESOP | 7 | 0.15 |
| | DOE-SR | 21 | 0.13 |

Strontium-**89,90** Activity Levels in Non-edible Catfish

pCi/g **( DRY )**

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | 0.21 |
| | DOE-SR | 3 | 0.12 |
| UTR | ESOP | 1 | 0.23 |
| | DOE-SR | 3 | 0.07 |
| BDC | ESOP | 1 | 0.23 |
| | DOE-SR | 3 | 0.12 |
| FMC | ESOP | 1 | 0.21 |
| | DOE-SR | 3 | 0.09 |
| STC | ESOP | 1 | 0.33 |
| | DOE-SR | 3 | 0.11 |
| LTR | ESOP | 1 | 0.27 |
| | DOE-SR | 3 | 0.15 |
| Hwy. 301 | ESOP | 1 | 0.17 |
| | DOE-SR | 3 | 0.11 |
| Average | ESOP | 7 | 0.24 |
| | DOE-SR | 21 | 0.11 |
| Standard Deviation | ESOP | 7 | 0.05 |
| | DOE-SR | 21 | 0.03 |

Notes: NSBLD = New Savannah Bluff Lock and Dam
UTR = Upper Three Runs
BDC = Beaver Dam Creek
FMC = Four Mile Creek
STC = Steel Creek
LTR = Lower Three Runs
Hwy. 301 = Savannah River at U.S. Hwy. 301
MDA = Minimum Detectable Activity
MDC = Minimum Detectable Concentration
DOE-SR data from WSRC 2007
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
Averages calculated using detections only

**Back to List of Data Tables**

## Radiological Monitoring of Fish Data
## ESOP and DOE-SR Data Comparison

Tritium Activity Levels in Edible Red Drum
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| Hwy. 17 | ESOP | 1 | 0.18 |
| | DOE-SR | 6 | 0.18 |

Tritium Activity Levels in Edible Seatrout
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| NSBLD | ESOP | 1 | 0.23 |
| | DOE-SR | 3 | 0.06** |

Tritium Activity Levels in Edible Mullet
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| Hwy. 17 | ESOP | 1 | 0.24 |
| | DOE-SR | 3 | <MDC |

Cs-137 Activity Levels in Edible Red Drum
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| Hwy. 17 | ESOP | 1 | <MDA |
| | DOE-SR | 6 | <MDC |

Cs-137 Activity Levels in Edible Seatrout
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| Hwy. 17 | ESOP | 1 | <MDA |
| | DOE-SR | 6 | <MDC |

Cs-137 Activity Levels in Edible Mullet
pCi/g

| Location | Agency | # of samples | Result |
|---|---|---|---|
| Hwy. 17 | ESOP | 1 | <MDA |
| | DOE-SR | 6 | <MDC |

Notes: NSBLD = New Savannah Bluff Lock and Dam
UTR = Upper Three Runs
BDC = Beaver Dam Creek
FMC = Four Mile Creek
STC = Steel Creek
LTR = Lower Three Runs
Hwy. 301 = Savannah River at U.S. Hwy. 301
MDA = Minimum Detectable Activity
MDC = Minimum Detectable Concentration
DOE-SR data from WSRC 2007
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
Averages calculated using detections only

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## 4.1.5 Summary Statistics
## Radiological Monitoring of Fish

**Tritium levels (pCi/L) in Savannah River Fish, 2006**

| Species | N | Average | Standard Deviation | Median | Minimum Detect | Maximum Detect |
|---|---|---|---|---|---|---|
| Largemouth bass | 9 ( 0 ) | 850 | 1010 | 385 | 265 | 2920 |
| Catfish | 7 ( 2 ) | 832 | 767 | 451 | 296 | 2104 |
| Common carp | 9 ( 0 ) | 809 | 849 | 566 | 188 | 2879 |

Edible composites only
Non-detects ( ) excluded from computations
Stevens Creek excluded from computations
Carp not collected from Stevens Creek

**Cs-137 levels (pCi/g) in Savannah River Fish, 2006**

| Species | Composite Type | N | Average | Standard Deviation | Median | Minimum Detect | Maximum Detect |
|---|---|---|---|---|---|---|---|
| Largemouth bass | Edible | 5 ( 4 ) | 0.181 | 0.140 | 0.198 | 0.039 | 0.391 |
| | Nonedible | 3 ( 6 ) | 0.127 | 0.058 | 0.107 | 0.081 | 0.192 |
| Catfish | Edible | 4 ( 5 ) | 0.079 | 0.048 | 0.072 | 0.035 | 0.135 |
| | Nonedible | 3 ( 6 ) | 0.061 | 0.023 | 0.051 | 0.045 | 0.088 |
| Common carp | Edible | 3 ( 6 ) | 0.066 | 0.020 | 0.063 | 0.048 | 0.088 |

Non-detects ( ) excluded from computations
Cs-137 not detected at Stevens Creek

**Sr-89,90 levels (pCi/g - Wet) in Stevens Creek and Savannah River Fish, 2006**

| Species | N | Average | Standard Deviation | Median | Minimum Detect | Maximum Detect |
|---|---|---|---|---|---|---|
| Largemouth bass | 10 ( 0 ) | 0.092 | 0.044 | 0.084 | 0.038 | 0.187 |
| Catfish | 10 ( 0 ) | 0.060 | 0.016 | 0.060 | 0.036 | 0.097 |

Non-edible composites only
Non-detects ( ) excluded from computations

**N** - denotes number of samples
Tritium results(pCi/L) represent the activity level in the water distilled from the fish tissue.
Cs-137 results represent the activity level in natural fish tissue.
Strontium results represent the activity level in an aliquot of wet fish tissue (calculated).

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## 4.2 Radiological Game Animal Monitoring Adjacent to SRS

### 4.2.1 Summary

White-tailed deer have access to a number of contaminated areas on the Savannah River Site (SRS), and consequently are a vector for the redistribution of contaminants, including cesium-137 (Cs-137), to off-site locations. Consumption of these wildlife species can result in the transfer of contaminants to humans. The radionuclide of concern is Cs-137 because of its relatively long physical half-life of 30 years, and its availability to game animals and associated health risk to humans.

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) conducts independent non-regulatory oversight of game animal monitoring activities at the SRS. The game animal project addresses concerns of potentially contaminated white-tailed deer migrating off the SRS by analyzing samples collected off-site. In 2006, SCDHEC analyzed muscle tissue for Cs-137 from 68 deer from within a five-mile study area adjacent to the SRS. Sixty tissue samples were collected and analyzed from a background location 120 miles northeast of the SRS.

The precise ranging behavior of individual deer on the SRS is unknown. Deer have access to contaminated areas on-site and it is possible that some animals migrate off-site where they can be harvested by local hunters. Sampling by ESOP of deer harvested off-site can provide valuable information concerning the potential off-site exposure to Cs-137.

**RESULTS AND DISCUSSION**

Analytical results are listed under each zone in section 4.2.4. Summary statistics are in section 4.2.5.

A total of 128 deer samples was collected. Sixty-eight samples were collected within five miles of the SRS perimeter (Map 13, section 4.2.2). Sixty deer background samples were collected 120 miles northeast of the SRS. ESOP compared total Cs-137 activities to DOE-SR results.

**Cesium-137 Activity**
Cs-137 and the naturally occurring potassium-40 (K-40) were the only isotopes detected in game samples collected in 2006. Cs-137 is readily incorporated into the human body because of its similarity to K-40 in physiological processes (Davis 1963). The Cs-137 concentrates in animal skeletal muscles, which are selectively consumed by hunters (Brisbin 1975). Cs-137 is an important radionuclide because of its relatively long physical half-life of 30 years and its associated health risks (Haselow 1991). Cs-137 emits both beta and gamma radiation, contributing to both internal and external radiation exposure, which may be associated with gastrointestinal, genetic, hemopoietic, and central nervous system damage (Bond 1965). Because of these concerns, Cs-137 will be the only isotope discussed in this report.

Cs-137 activities from the 68 white-tailed deer perimeter samples ranged from < MDA to 3.90 picocuries per gram (pCi/g), with an average of 1.29 ± 1.05 pCi/g (section 4.2.5). Sample results
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from the 60 deer collected 120 miles northeast of the SRS ranged from 1.17 pCi/g to 7.02 pCi/g, with an average of 3.90 ± 1.38 pCi/g. DOE-SR reported an approximate field measurement range of 1 pCi/g to 9 pCi/g, with an average of 2.65 pCi/g, from 324 deer harvested on the SRS in 2006 (WSRC 2007). Average SCDHEC study area and background, and DOE-SR on-SRS Cs-137 levels for the past five years are indicated in Figure 1, section 4.2.3. The 2006 study area Cs-137 average result (1.29 ± 1.05 pCi/g) is within two standard deviations of the SCDHEC background result (3.90 ± 1.38 pCi/g). The 2002 to 2006 SCDHEC average Cs-137 activity (1.50 ± 0.44 pCi/g) was approximately four standard deviations different from the DOE-SR average (3.18 ± 1.17 pCi/g).

**CONCLUSIONS AND RECOMMENDATIONS**

Although Cs-137 was deposited on the SRS from site operations, levels found in the study and background locations are likely results of global aboveground nuclear weapons testing (Jannik 1997). DOE-SR does not collect game animal samples within the SCDHEC study area and off-site hunter doses are based on DOE-SR models; therefore, no direct comparisons could be made between ESOP and DOE-SR data.

Age, sex, body weight, soil type and location of collection may affect the Cs-137 activities found in white-tailed deer (Haselow 1991). A portion of the elevated Cs-137 activity found in deer harvested in hunt zones five and seven may be attributed to historic SRS operations. These operations released known Cs-137 contamination to Steel Creek and Lower Three Runs, their floodplains, and the Savannah River swamp, all of which impact hunt zones five and seven. Further research may be needed to help determine why elevated Cs-137 activities are found in other hunt units.

The precise ranging behavior of individual deer on the SRS is unknown. Deer have access to contaminated areas on-site and it is possible that some animals migrate off-site where they can be harvested by local hunters. Sampling by ESOP of deer harvested off-site can provide valuable information concerning the potential off-site exposure to Cs-137.

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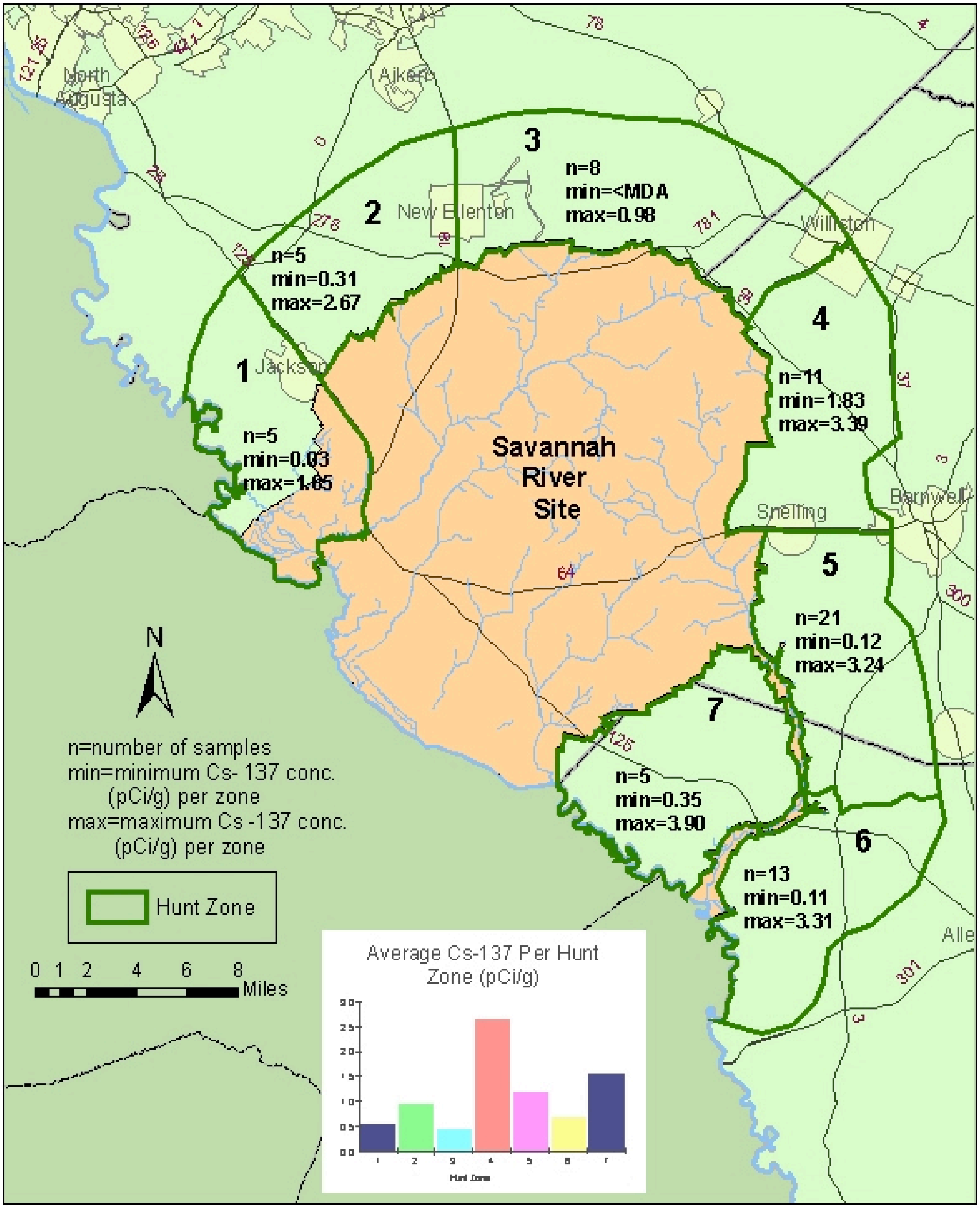
## 4.2.2
## Map 13. Radiological Monitoring of Game Animals Locations

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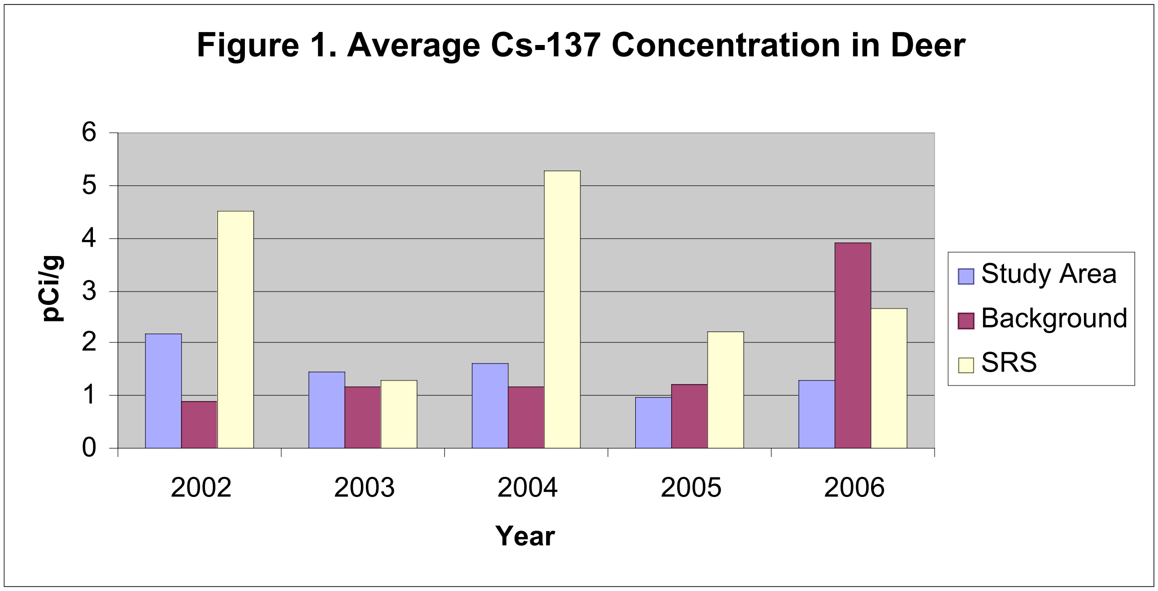
### 4.2.3 Tables and Figures
### Radiological Game Animal Monitoring

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### 4.2.4 Data
### Radiological Game Animal Monitoring Adjacent to SRS Data



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# Radiological Game Monitoring
## Game Animal Monitoring Data

| Sample Location | | Zone-1 | Zone-1 | Zone-1 | Zone-1 | Zone-1 |
|---|---|---|---|---|---|---|
| Sample Date | | 10/20/2006 | 10/20/2006 | 10/20/2006 | 10/20/2006 | 10/20/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Buck | Buck |
| Weight | Pounds | 155 | 125 | 125 | 135 | 105 |
| Cesium-137 | (pCi/g) wet | 0.76 | 0.05 | 0.03 | 0.14 | 1.85 |
| Uncertainty | (+/- 2sig) | 0.07 | 0.02 | 0.01 | 0.02 | 0.16 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |

| Sample Location | | Zone-2 | Zone-2 | Zone-2 | Zone-2 | Zone-2 |
|---|---|---|---|---|---|---|
| Sample Date | | 10/1/2006 | 10/1/2006 | 10/1/2006 | 10/1/2006 | 10/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Buck | Doe | Buck | Doe |
| Weight | Pounds | 90 | 215 | 90 | 45 | 85 |
| Cesium-137 | (pCi/g) wet | 2.67 | 0.60 | 0.87 | 0.41 | 0.31 |
| Uncertainty | (+/- 2sig) | 0.22 | 0.06 | 0.09 | 0.06 | 0.06 |
| MDA | (pCi/g) wet | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 |

| Sample Location | | Zone-3 | Zone-3 | Zone-3 | Zone-3 | Zone-3 | Zone-3 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 10/1/2006 | 10/1/2006 | 12/31/2006 | 12/31/2006 | 12/31/2006 | 12/31/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Doe | Doe | Doe |
| Weight | Pounds | 120 | 140 | 105 | 115 | 85 | 90 |
| Cesium-137 | (pCi/g) wet | 0.13 | 0.10 | 0.48 | 0.74 | 0.59 | 0.48 |
| Uncertainty | (+/- 2sig) | 0.03 | 0.03 | 0.07 | 0.08 | 0.06 | 0.06 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Sample Location | | Zone-3 | Zone-3 |
|---|---|---|---|
| Sample Date | | 12/31/2006 | 12/31/2006 |
| Species | | Deer | Deer |
| Sex | | Doe | Doe |
| Weight | Pounds | 75 | 95 |
| Cesium-137 | (pCi/g) wet | < MDA | 0.98 |
| Uncertainty | (+/- 2sig) | NA | 0.09 |
| MDA | (pCi/g) wet | 0.03 | 0.03 |

| Sample Location | | Zone-4 | Zone-4 | Zone-4 | Zone-4 | Zone-4 | Zone-4 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 9/30/2006 | 11/15/2006 | 11/15/2006 | 12/16/2006 | 12/16/2006 | 12/16/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Doe | Buck | Doe | Doe | Buck |
| Weight | Pounds | 105 | 95 | 40 | 95 | 100 | 65 |
| Cesium-137 | (pCi/g) wet | 3.39 | 2.46 | 2.79 | 2.45 | 2.64 | 3.25 |
| Uncertainty | (+/- 2sig) | 0.27 | 0.21 | 0.23 | 0.18 | 0.19 | 0.24 |
| MDA | (pCi/g) wet | 0.05 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |

| Sample Location | | Zone-4 | Zone-4 | Zone-4 | Zone-4 | Zone-4 |
|---|---|---|---|---|---|---|
| Sample Date | | 12/16/2006 | 12/16/2006 | 12/16/2006 | 12/16/2006 | 12/16/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Doe | Doe | Doe | Doe |
| Weight | Pounds | 85 | 75 | 85 | 90 | 100 |
| Cesium-137 | (pCi/g) wet | 1.92 | 1.83 | 3.10 | 3.00 | 2.15 |
| Uncertainty | (+/- 2sig) | 0.15 | 0.15 | 0.23 | 0.22 | 0.17 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Sample Location | | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 10/7/2006 | 10/7/2006 | 10/8/2006 | 10/8/2006 | 10/13/2006 | 10/13/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Doe | Doe | Doe | Buck | Doe |
| Weight | Pounds | 100 | 110 | 115 | 110 | 140 | 45 |
| Cesium-137 | (pCi/g) wet | 1.39 | 0.47 | 0.66 | 2.37 | 1.97 | 1.91 |
| Uncertainty | (+/- 2sig) | 0.12 | 0.06 | 0.07 | 0.21 | 0.16 | 0.16 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 |

Notes:
MDA - Minimum Detectable Activity

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## Radiological Game Monitoring
## Game Animal Monitoring Data

| Sample Location | | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 10/15/2006 | 10/25/2006 | 10/18/2006 | 10/18/2006 | 10/26/2006 | 10/21/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Doe | Buck | Buck |
| Weight | Pounds | 140 | 195 | 225 | 65 | 120 | 125 |
| Cesium-137 | (pCi/g) wet | 0.71 | 0.37 | 0.35 | 3.24 | 0.16 | 1.13 |
| Uncertainty | (+/- 2sig) | 0.08 | 0.05 | 0.05 | 0.25 | 0.04 | 0.10 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 |

| Sample Location | | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 | Zone-5 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 10/26/2006 | 10/30/2006 | 10/31/2006 | 10/26/2006 | 10/31/2006 | 10/27/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Doe | Buck | Buck | Buck | Buck |
| Weight | Pounds | 135 | 115 | 140 | 115 | 125 | 135 |
| Cesium-137 | (pCi/g) wet | 1.40 | 2.41 | 0.57 | 2.44 | 1.26 | 0.12 |
| Uncertainty | (+/- 2sig) | 0.12 | 0.20 | 0.07 | 0.20 | 0.12 | 0.04 |
| MDA | (pCi/g) wet | 0.04 | 0.04 | 0.03 | 0.03 | 0.04 | 0.03 |

| Sample Location | | Zone-5 | Zone-5 | Zone-5 |
|---|---|---|---|---|
| Sample Date | | 12/4/2006 | 12/4/2006 | 12/4/2006 |
| Species | | Deer | Deer | Deer |
| Sex | | Buck | Doe | Buck |
| Weight | Pounds | 130 | 100 | 60 |
| Cesium-137 | (pCi/g) wet | 0.84 | 1.06 | 0.85 |
| Uncertainty | (+/- 2sig) | 0.09 | 0.09 | 0.09 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.04 |

| Sample Location | | Zone-6 | Zone-6 | Zone-6 | Zone-6 | Zone-6 | Zone-6 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Doe | Doe | Buck |
| Weight | Pounds | 140 | 90 | 65 | 90 | 85 | 50 |
| Cesium-137 | (pCi/g) wet | 0.30 | 0.97 | 0.11 | 0.68 | 0.39 | 3.31 |
| Uncertainty | (+/- 2sig) | 0.04 | 0.09 | 0.04 | 0.08 | 0.06 | 0.28 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 |

| Sample Location | | Zone-6 | Zone-6 | Zone-6 | Zone-6 | Zone-6 | Zone-6 |
|---|---|---|---|---|---|---|---|
| Sample Date | | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 | 11/24/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Buck | Buck | Doe | Buck | Doe |
| Weight | Pounds | 85 | 100 | 130 | 105 | 165 | 45 |
| Cesium-137 | (pCi/g) wet | 1.60 | 0.54 | 0.60 | 1.78 | 0.50 | 0.70 |
| Uncertainty | (+/- 2sig) | 0.15 | 0.06 | 0.07 | 0.16 | 0.06 | 0.08 |
| MDA | (pCi/g) wet | 0.04 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 |

| Sample Location | | Zone-6 |
|---|---|---|
| Sample Date | | 11/24/2006 |
| Species | | Deer |
| Sex | | Doe |
| Weight | Pounds | 70 |
| Cesium-137 | (pCi/g) wet | 0.56 |
| Uncertainty | (+/- 2sig) | 0.06 |
| MDA | (pCi/g) wet | 0.03 |

| Sample Location | | Zone-7 | Zone-7 | Zone-7 | Zone-7 | Zone-7 |
|---|---|---|---|---|---|---|
| Sample Date | | 12/30/2006 | 12/30/2006 | 12/30/2006 | 12/30/2006 | 12/30/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Doe | Buck | Buck | Doe |
| Weight | Pounds | 125 | 95 | 115 | 100 | 50 |
| Cesium-137 | (pCi/g) wet | 0.35 | 2.18 | 0.38 | 1.04 | 3.90 |
| Uncertainty | (+/- 2sig) | 0.06 | 0.24 | 0.06 | 0.12 | 0.39 |
| MDA | (pCi/g) wet | 0.03 | 0.05 | 0.02 | 0.02 | 0.02 |

Notes:
MDA - Minimum Detectable Activity

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## Radiological Game Monitoring
## Background Data

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Buck | Buck |
| Weight | Pounds | 162 | 150 | 93 | 109 | 145 |
| Cesium-137 | (pCi/g) wet | 4.86 | 3.93 | 3.68 | 1.18 | 2.95 |
| Uncertainty | (+/- 2sig) | 0.48 | 0.39 | 0.37 | 0.13 | 0.29 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Buck | Buck |
| Weight | Pounds | 125 | 109 | 132 | 150 | 122 |
| Cesium-137 | (pCi/g) wet | 4.13 | 6.35 | 2.68 | 4.71 | 4.32 |
| Uncertainty | (+/- 2sig) | 0.41 | 0.63 | 0.27 | 0.47 | 0.43 |
| MDA | (pCi/g) wet | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Doe | Buck | Buck | Buck |
| Weight | Pounds | 92 | 94 | 140 | 108 | 100 |
| Cesium-137 | (pCi/g) wet | 6.31 | 5.48 | 3.11 | 3.77 | 4.35 |
| Uncertainty | (+/- 2sig) | 0.63 | 0.55 | 0.31 | 0.38 | 0.44 |
| MDA | (pCi/g) wet | 0.04 | 0.03 | 0.02 | 0.02 | 0.03 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Buck | Buck |
| Weight | Pounds | 115 | 123 | 154 | 152 | 90 |
| Cesium-137 | (pCi/g) wet | 5.51 | 5.08 | 2.93 | 4.25 | 3.73 |
| Uncertainty | (+/- 2sig) | 0.55 | 0.42 | 0.25 | 0.35 | 0.31 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Doe | Buck |
| Weight | Pounds | 110 | 132 | 135 | 72 | 144 |
| Cesium-137 | (pCi/g) wet | 4.44 | 4.13 | 2.57 | 4.54 | 1.74 |
| Uncertainty | (+/- 2sig) | 0.37 | 0.34 | 0.22 | 0.39 | 0.15 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.04 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Doe | Buck | Buck | Buck |
| Weight | Pounds | 105 | 100 | 95 | 150 | 110 |
| Cesium-137 | (pCi/g) wet | 4.00 | 2.75 | 4.72 | 4.05 | 2.59 |
| Uncertainty | (+/- 2sig) | 0.33 | 0.24 | 0.39 | 0.34 | 0.22 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 |

Notes:
MDA - Minimum Detectable Activity

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## Radiological Game Monitoring
## Background Data

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Buck | Buck | Doe |
| Weight | Pounds | 100 | 126 | 120 | 118 | 83 |
| Cesium-137 | (pCi/g) wet | 3.79 | 2.22 | 3.93 | 3.10 | 5.92 |
| Uncertainty | (+/- 2sig) | 0.32 | 0.19 | 0.39 | 0.31 | 0.59 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Buck | Doe | Buck | Doe |
| Weight | Pounds | 80 | 105 | 95 | 119 | 91 |
| Cesium-137 | (pCi/g) wet | 3.26 | 3.15 | 4.31 | 3.75 | 3.19 |
| Uncertainty | (+/- 2sig) | 0.33 | 0.32 | 0.43 | 0.38 | 0.32 |
| MDA | (pCi/g) wet | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Buck | Doe | Doe | Buck |
| Weight | Pounds | 59 | 115 | 109 | 92 | 130 |
| Cesium-137 | (pCi/g) wet | 3.82 | 1.84 | 2.93 | 5.25 | 1.55 |
| Uncertainty | (+/- 2sig) | 0.39 | 0.19 | 0.29 | 0.53 | 0.16 |
| MDA | (pCi/g) wet | 0.03 | 0.03 | 0.02 | 0.04 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Buck | Buck | Doe | Doe |
| Weight | Pounds | 98 | 124 | 145 | 85 | 56 |
| Cesium-137 | (pCi/g) wet | 2.13 | 3.11 | 4.86 | 3.09 | 3.11 |
| Uncertainty | (+/- 2sig) | 0.18 | 0.26 | 0.40 | 0.27 | 0.27 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Doe | Buck | Buck | Doe | Buck |
| Weight | Pounds | 95 | 140 | 128 | 95 | 117 |
| Cesium-137 | (pCi/g) wet | 1.17 | 2.24 | 2.52 | 5.63 | 5.60 |
| Uncertainty | (+/- 2sig) | 0.15 | 0.19 | 0.21 | 0.47 | 0.46 |
| MDA | (pCi/g) wet | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |

| Sample Location | | Background | Background | Background | Background | Background |
|---|---|---|---|---|---|---|
| Sample Date | | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 | 11/3/2006 |
| Species | | Deer | Deer | Deer | Deer | Deer |
| Sex | | Buck | Doe | Doe | Buck | Doe |
| Weight | Pounds | 103 | 110 | 78 | 123 | 82 |
| Cesium-137 | (pCi/g) wet | 5.92 | 6.00 | 6.10 | 4.61 | 7.02 |
| Uncertainty | (+/- 2sig) | 0.49 | 0.50 | 0.51 | 0.38 | 0.58 |
| MDA | (pCi/g) wet | 0.02 | 0.03 | 0.03 | 0.02 | 0.03 |

Notes:
MDA - Minimum Detectable Activity

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## 4.2.5 Summary Statistics
## Radiological Game Monitoring

Cs-137 concentration (pCi/g wet weight) in deer collected in 2006

| | N | Average | Std. Dev. | Median | Min. | Max |
|---|---|---|---|---|---|---|
| **Study Area** | 68 | 1.29 | 1.05 | 0.85 | < MDA | 3.90 |
| **Background** | 60 | 3.90 | 1.38 | 3.86 | 1.17 | 7.02 |

Notes:
N - Number of Samples
Std.Dev. - Standard Deviation
Min - Minimum
Max - maximum
MDA - Minimum Detectable Activity

Cs-137 concentration (pCi/g wet weight) in deer collected from 2002 - 2006

| | Year | N | Average | Std.Dev | Median | Min. | Max. |
|---|---|---|---|---|---|---|---|
| **Study Area** | 2002 | 56 | 2.18 | 1.86 | 1.68 | 0.37 | 8.86 |
| **Background** | 2002 | 6 | 0.90 | 0.41 | 0.76 | 0.58 | 1.67 |
| **SRS** | 2002 | 1316 | 4.49 | NA | NA | 1.00 | 18.00 |
| **Study Area** | 2003 | 50 | 1.46 | 1.31 | 1.09 | 0.07 | 5.80 |
| **Background** | 2003 | 7 | 1.17 | 0.88 | 0.78 | 0.49 | 2.92 |
| **SRS** | 2003 | 1128 | 1.29 | NA | NA | 1.00 | 17.10 |
| **Study Area** | 2004 | 50 | 1.60 | 1.10 | 1.31 | 0.07 | 4.56 |
| **Background** | 2004 | 15 | 1.16 | 0.63 | 1.18 | 0.34 | 2.44 |
| **SRS** | 2004 | 817 | 5.26 | NA | NA | 1.00 | 48.3 |
| **Study Area** | 2005 | 66 | 0.98 | 0.87 | 0.70 | < MDA | 4.32 |
| **Background** | 2005 | 15 | 1.19 | 0.38 | 1.25 | 0.48 | 1.60 |
| **SRS** | 2005 | 215 | 2.32 | NA | NA | 1.00 | 8.10 |
| **Study Area** | 2006 | 68 | 1.29 | 1.05 | 0.85 | < MDA | 3.90 |
| **Background** | 2006 | 60 | 3.90 | 1.38 | 3.86 | 1.17 | 7.02 |
| **SRS** | 2006 | 324 | 2.65 | NA | NA | 1.00 | 9.05 |
| **Study Area** | ' 02 - ' 06 | 290 | 1.50 | 0.44 | 1.46 | < MDA | 8.86 |
| **Background** | ' 02 - ' 06 | 103 | 1.66 | 1.26 | 1.17 | 0.34 | 7.02 |
| **SRS** | ' 02 - ' 06 | 3800 | 3.18 | 1.17 | 2.65 | 1.00 | 48.30 |

Notes:
N - Number of Samples
Min - Minimum
Max - Maximum
MDA - Minimum Detectable Activity

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## 5.1 Critical Pathway

### 5.1.1 Summary

The Department of Energy - Savannah River (DOE-SR) operates the Savannah River Site (SRS), a government facility located in South Carolina that produced nuclear materials for national defense during the Cold War era. Throughout its operational history, there have been documented instances of radiological materials released to the environment during production activities. The potential exposure pathway trends were determined from SRS release information from 1993 through 2006. A historical review of DOE documented instances of radiological materials released to the environment during the site's history was included in previous SCDHEC reports. Only recent data from DOE-SR and the South Carolina Department of Health and Environmental Control (SCDHEC) was examined in this report. Emphasis was placed on releases that occurred during the past eight years (1993-2000) and on more recent dose estimates to the Maximally Exposed Individual (MEI) through 2006. The SCDHEC sportsman scenario dose projections were compared to recent SRS reports and to the phase III "Draft for Public Comment" SRS Dose Reconstruction scenarios 39-yr dose estimate by the United States Centers for Disease Control (CDC 2004). Projections based on similar media in the DOE-SR and SCDHEC MEI Sportsman dose indicated an expected drop in public dose exposure over the next 39-yr period. The primary radiological contaminants released by the SRS and the exposure pathways leading from the SRS to the surrounding public were identified from document reviews and recent data. This assessment of radiological contaminants included dose contributions to four possible critical pathway scenarios.

**PRIMARY EXPOSURE PATHWAYS INDICATED BY SRS RELEASES VERSUS ESOP DETECTED DOSES**

Based on DOE-SR release information the two main potential environmental pathways from the SRS to the surrounding public were atmospheric and liquid. An exposure pathway diagram is depicted in figure 6, section 5.1.2. The environmental mediums receiving mostly atmospheric releases included air, soil, and food. The environmental mediums receiving mostly liquid releases were food, surface water, and groundwater. These environmental mediums were part of the potential exposure pathways to the public. The atmospheric and resuspended soil contamination contributed to the inhalation, plume (atmospheric releases that can affect the public through dermal contact), and ground exposure pathways. The drinking water, swimming, boating and shoreline exposure pathways were created when surface water was used for drinking water and recreational purposes. The consumption of vegetation, milk, fish, and game animal (also known as the sportsman exposure pathway) contributed to the food medium ingestion pathway.

Exposure routes connected the exposure pathways to the surrounding public. The percent of potential exposure from the atmospheric pathway was not verified by actual detections (ESOP detections) in affected media due to the nonuniform nature of weather depositional patterns. The three main potential exposure routes included inhalation, dermal absorption, and ingestion. Inhalation included breathing in atmospheric plumes, resuspended soil, and sediments. Dermal absorption and ingestion can occur through atmospheric and liquid plumes, swimming, boating,

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and shoreline exposure pathways. Food and water environmental mediums lead to the surrounding public's ingestion exposure route. Thus, it is important to make the distinction between calculated dose based on potential from estimated releases (DOE-SR calculations, Section 5.1.3), and actual dose detections in observed media (ESOP data summaries, Section 5.1.4). Also, the MEI detected dose that was potential Naturally Occurring Radioactive Material (NORM) could be excluded if the contributions were not observed in other media affected by the same pathway. However, ESOP included an MEI plus potential NORM dose for conservatism in dose calculations. Thus, an MEI dose and an MEI plus NORM dose was included in ESOP 2006 observations (SCDHEC 2007).

Data from the Potential Radiation Doses section of the SRS Environmental Reports for 1993 through 2007 were used to graph exposure pathway trends for both atmospheric and liquid releases. Data used for atmospheric releases were taken from the DOE-SR MAXDOSE-SR computer modeling code using the consumption of cow milk pathway. The data used to develop the DOE-SR graphs can be found in Section 5.1.2. Each estimated pathway dose from DOE-SR releases is compared to actual SCDHEC dose detections. Some potential dose due to NORM could not be separated from the NORM that may have originated at the SRS.

**Atmospheric Pathway**

The potential dose to the MEI from SRS atmospheric releases is shown in Figure 1, section 5.1.2. The potential inhalation and vegetation exposure pathways from aerial contamination have been the dominant releases during the last fourteen years. Other pathways that represent a smaller fraction of the atmospheric dose included cow milk, meat, ground and plume. The National Emissions Standards for Hazardous Air Pollutants for all radionuclide air pollutants in 2006 was 0.06 mrem for the MEI effective dose equivalent (WSRC 2007), and 0.11 mrem for the calculated MAXDOSE-SR estimate. The higher MAXDOSE-SR calculations was attributed to diffuse and fugitive releases of alpha and beta primarily from the General Separations Area Consolidated Unit (WSRC 2007). The atmospheric pathway contributed dose to the individual through the inhalation, ingestion (cow milk, vegetation, rainwater, and meat), and direct exposure routes. The potential NORM dose to the atmospheric pathway was 1.17 mrem and added to the MEI observed dose (Figure 3, section 5.1.2).

Air

The air medium contributes to the plume, ground, inhalation, and food exposure pathways. As shown in Figure 1, the plume exposure pathway potential has not exceeded one percent of the total dose to the MEI in the last fourteen years. However, the inhalation exposure pathway potential is much more than 1 percent of the total potential committed dose to the MEI. Unspecified alpha, tritium, Cs-137, nonvolatile beta, Pu-238, and I-129 account for the majority of the total potential committed dose to the MEI from air releases since 1999 (Table G1, section 5.1.3). The DOE-SR calculated dose to the vegetation, cow milk, and meat pathways (food) were 52.1% of the atmospheric releases in 2006 (Table H1, section 5.1.3). The DOE-SR calculated dose to the inhalation pathway was 41.6% of the atmospheric releases in 2006. The DOE-SR calculated dose to the ground pathway was 6.4 % from atmospheric releases.

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The ESOP MEI detected dose potential from the atmospheric pathway totaled 3.90 mrem in 2006. The inhalation percentage was 0.26 % (0.01/3.90*100) of this total. Exposure from food detections subject to the atmospheric pathways was 34.87 % (( 0.01+0.20+1.15)/3.90*100) of the total atmospheric detections. Thus, the respective percentage comparisons to DOE-SR calculated releases were 17.23 % less for food detections and 41.34 % less for inhalation. Thus, dose uptake after deposition from the atmospheric pathway is a dominant route of exposure to the public via the food pathway. Not all SRS dose releases result in depositions within the sample area as evidenced by the inhalation pathway detections. Also, many years of cumulative dose depositions contribute to the dose detections in any given year and make release of potential dose versus uptake detections not directly comparable. Only the detected exposure based on uptake is a meaningful indicator of dose to the public. Therefore, the average of several years of radionuclide detections on a dose basis is a more relevant indicator of exposure to the public than percentages. The ESOP detected inhalation air dose averaged 0.01 mrem ± 0.01 mrem (standard deviation) with a median of 0.01 mrem from 1999-2006 (Table 3, section 5.1.4). The total percent for all media detections possibly of atmospheric origin for the average dose for 1999 through 2006 was 73.76 % (0.45+0.01+33.42+0.26+0.16+2.81+13.73+22.92). The balance of the detected dose was from liquid pathway media.

Soil

The soil medium includes the accumulation of radionuclides in the ground exposure pathway from atmospheric releases. DOE-SR detected the following radionuclides in soil samples collected off SRS in 2006: Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Am-241, and Cm-244 (WSRC 2007).

ESOP detected the following radionuclides in soil above the South Carolina background and within a 50-mile perimeter of an SRS centerpoint: Pb-212, Pb-214, Ra-226, Zn-65, Ac-228, Cs-137, alpha assigned as Pu-239, and beta assigned as Sr-90. The total dose from soil was 54.73 % of the ESOP total detected dose for the MEI including NORM (0.82+0.01+0.04+0.31+2.52) /6.76*100) (Table 1, section 5.1.4). The soil dose for 1999-2006, excluding NORM, averaged 0.01 mrem ± 0.01 with a median of 0.01 mrem (Table 3, section 5.1.4).

Food

The DOE-SR cow milk pathway indicated that vegetation (46.27%), cow milk (1.46%), and meat (4.32%) were the main exposure pathways to the MEI for the food medium from atmospheric releases (Table H1, section 5.1.3). Tritium and alpha accounted for the majority of potential dose from air releases to the food pathway (WSRC 2007). However, actual detections in 2006 included cesium-137 (in collards, corn, and soybeans), Sr-89,90 (in collards, corn, and soybeans), tritium (in collards), U-234 and U-238 (in soybeans, corn, and beef), Am-241 (in corn, pecans, and soybeans), and gross beta (in all food products) (WSRC 2007). ESOP detected dose in edible plants (0.22%) came from tritium in fruits and leafy vegetables. The cow milk detected dose (4.45%) came from Sr-89/90 and tritium.

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The MEI deer dose was from Cs-137 for the single hunter (25.61%) who consumed the worst-case deer. The MEI deer average dose (worst case) was always higher in any year compared to the deer average. ESOP food dose average trends (Figure 2 section 5.1.2) above the South

Carolina background indicated that hog had the highest average dose in 2002 with an average of 1.53 mrem ± 1.87 (0.97 median) for 2000-2002. The deer average dose for 2000-2006 was 0.39 mrem ± 0.51 (median 0.21). The MEI hog average for the years collected was 7.08 mrem ± 8.81 (median 4.29) (Table 3, section 5.1.4). The MEI deer average dose (2000-2006) was greater (9.27 mrem ± 6.52, median 7.64 mrem), possibly due to the greater number of samples collected. Fish was third for food average ingestion dose (0.51 mrem ± 0.27, median 0.44 mrem), but was greater than average deer in all years except 2002 and 2004. However, the MEI deer average was always higher than the fish dose average in any year. Milk dose was fourth at 0.07 mrem ± 0.08 (median 0.05), and vegetables was fifth at 0.01 mrem ± 0.00 (median 0.01). The nonsportsman public food (milk and vegetables) average dose (0.04 mrem ± 0.04 (median 0.05) was much lower than the sportsman food (fish, deer, hog) average dose (4.51 mrem ± 3.96, median 3.27 mrem). The median may be a more accurate center point indicator than the average for large amounts of data, since the influence of extremes is less.

Vegetation

Bermuda grass was sampled by DOE-SR in 2006 and the following radionuclides were found that could impact herbivores: tritium, Cs-137, Sr-89/90, U-234, U-238, Pu-238, and Am-241 at SRS perimeter locations (WSRC 2007). ESOP edible vegetation dose averaged 0.01 mrem with a median of 0.01 mrem from 2002 through 2006 (Table 3, section 5.1.4).

**Liquid Pathway**

Figure 3, section 5.1.2 illustrates the potential dose to the MEI from liquid releases. Consumption of fish (59%) and water (41%) dominate the liquid environmental pathway potential dose to the MEI from liquid releases. Exposure pathways for shoreline, boating, and swimming contributed less than one percent each of the total dose to the MEI (Table H1, section 5.1.3). The primary radioisotope potential contributors to the MEI dose for the liquid pathway were Cs-137 (56% of total dose), unspecified alpha (24%), and tritium (17%) (Table G2, section 5.1.3). Uranium-234, U-235, Am-241, and gross beta were also detected in Savannah River water. No drinking water exceeded the Environmental Protection Agency (EPA) alpha maximum contaminant level (MCL) of 15 pCi/L, the beta limit of 8 pCi/L, or tritium limit of 20,000 pCi/L (WSRC 2007).

Figure 4, section 5.1.2 illustrates the trend in ESOP detected dose from all water sources sampled from 1999 through 2006. The upward trends in groundwater and surface water samples since 2003 were due to improved background sampling locations with lower average alpha and beta detections. This increased dose was biased on the high side by assigning unknown alpha and beta as Pu-239 and Sr-90 respectively, whereas some of this dose may be due to NORM. However, dose summary statistics (section 5.1.4) indicated that the trends in yearly dose from the South Carolina Department of Natural Resources (SCDNR) groundwater well samples were

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within three standard deviations. Variations in locations, number, and types of samples account for some of this variance. DNR wells upgradient of SRS excluded radium and uranium NORM dose. Since 2003, ESOP has gradually expanded numbers and types of samples collected, especially in the random sample category. The trends for surface water, and Savannah River and Groundwater public water supplies would be relatively flat and variances (Table 3, section 5.1.4) within one standard deviation if unknown alpha and beta were excluded (SCDHEC 2007). The total

observed dose for all drinking water pathways was 7.35% (0.33/4.49*100) of the MEI or 21.15% ((0.33+1.10)/6.76*100) of the MEI plus NORM. However, only one drinking water source must be assumed and the worst-case dose was from DNR well water observations (assumed to represent private well water) whether MEI (3.34% of dose) or MEI plus NORM (18.49% of dose) (Table 1,section 5.1.4).

The only other ESOP detected dose from the Liquid Pathway was from fish consumption, which was 9.80% of the MEI (0.44/4.49*100) or 6.51% of the MEI plus NORM (0.44/6.67*100) (Table 1, section 5.1.4). The total dose from the liquid pathway worst-case MEI excluding NORM was 0.15 mrem for drinking private well water (DNR well water basis), and 0.44 mrem from fish consumption. The total dose from the liquid pathway to the private well owner worst-case MEI plus NORM was 1.25 mrem or 18.49% of the total detected dose. Thus, approximately half of the SCDHEC detected dose from the liquid pathway came from NORM.

Aquatic Food

Aquatic food in the liquid pathway was represented by fish and shellfish samples (WSRC 2007). Fish was a main exposure pathway in the food environmental medium for 2006. This pathway (50.1%) has contributed a slightly greater portion of the liquid releases to the MEI than water (49.8%) during the last fourteen years (Table H1, section 5.1.3). No pesticides or herbicides were found, but mercury was detected in bass, catfish, and bream. Aquatic food detections included Cs-137, I-129, Tc-99, Sr-89/90, tritium, and Pu-238 in Savannah River fish samples. Strontium-89/90, U-234, U-235, U-238, and Pu-238 were detected in saltwater fish and shellfish collected by DOE-SR (WSRC 2007).

ESOP did not sample shellfish in 2006, but did detect dose in bass, catfish, and carp. The highest dose came from bass (0.44 mrem) and over 99% of that dose was from Cs-137. Fish averaged 0.51 mrem ± 0.27 with a median of 0.44 mrem for 1999 through 2006 (Table 3, section 5.1.4).

Surface Water

A portion of the dose from the liquid pathway was contributed by the consumption of surface water as drinking water. Boating and swimming are also considered part of this environmental medium, though only for dermal absorption and for incidental ingestion while swimming. Dose from rainwater indicated possible atmospheric contributions to surface water and runoff at SRS perimeter locations. Rainwater radionuclide detections (alpha, beta, U-234, U-238, Am-241, Pu-238, and Sr-89/90) were near or below background levels (WSRC 2007).

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SRS streams have contributions from groundwater, surface water runoff (primarily stormwater), and rainwater. Tritium, alpha, and beta were the dominant contributors to dose. Detections in the Savannah River included tritium, U-234, U-235, and Am-241.

ESOP observed tritium in rainwater (0.01 mrem) was a potential dose addition to the liquid pathway from the atmospheric pathway and to any cisterns still utilized as drinking water sources. The potential surface water maximum dose (0.07 mrem) came from the Savannah River

and was 1.56% of the MEI dose. Surface water averaged 0.06 mrem ± 0.02 with a median of 0.06 mrem from 1999 through 2006 (Table 3, section 5.1.4).

Groundwater

Due to the half-life of tritium and the slow movement of groundwater groundwater tritium plumes on the SRS should decay to near zero before upwelling at any appreciable distance. Aquifer recharge from rainwater is expected to maintain tritium levels of less than 1,000 pCi/L based on SRS monitoring wells in Georgia (WSRC 2007). This seems accurate since ESOP rainwater detections averaged 240 pCi/L and the groundwater background was 329 pCi/L. The sitewide Groundwater Surveillance Monitoring Program should detect any plume movement in time to allow appropriate corrective action. Several strategies are used to prevent plume migration: pump and treat, in situ pH adjustment, steam injection, phytoremediation, and barrier wall construction. Contaminated groundwater has not contaminated wells outside SRS, but does have the potential to discharge to SRS streams. The main contaminants in groundwater plumes on the SRS (trichloroethylene, perchloroethylene, vinyl chloride, tritium, gross alpha, and beta) are monitored and remediated by the Soil and Groundwater Closure Projects Department pursuant to the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

ESOP groundwater dose detections occurred in public water supply wells (0.04 mrem) and DNR monitoring wells (0.15 mrem to the MEI plus 1.10 mrem of NORM) around the SRS. Public water supply well dose was much lower than DNR well dose, possibly due to the type of well construction and depth for public water wells versus monitoring wells. Public water well dose was due to unknown alpha, whereas DNR monitoring well dose was due to unknown alpha, total uranium, Ra-226 (most of the detected dose) and Ra-228. Goundwater monitoring wells (SCDNR) averaged 0.06 mrem ± 0.07 with a median of 0.03 mrem from 1999 through 2006. Public water supply wells averaged 0.02 mrem ± 0.02 with a median of 0.02 mrem from 1999 through 2006 (Table 3, section 5.1.4).

Sediments

Most radionuclides deposit on stream beds or at swamp entrances, and were higher in the SRS streams than the Savannah River. Resuspension and deposition of existing sediments constantly changes the concentrations at locations, and affects any colocation comparisons. Cesium-137, Sr-89/90, Co-60, Pu-238, Pu-239, U-234, U-235, and U-238 were observed in river and stream sediments (WSRC 2007).
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The radionuclides in sediments represent a potential dose based on the sediments becoming exposed if the Savannah River dried up to the point of exposing sediments. Beta, Cs-137, and Tc-99 were detected above background at Steel Creek Landing. Only nonvolatile beta assigned as Sr-90 in dry sediment would result in a dose at two significant places. Over half of this dose is based on sediment inhalation as dried resuspended soil and is not backed up by air station detections for beta at the indicated levels, and wet soil and ground roughness at riverbanks would greatly reduce beta exposure. Thus, this hypothetical sediment dose is not assigned to the MEI. ESOP plans to sample dry riverbank soil in 2007 to improve the soil exposure analysis for the boat landing locations.

**Sportsman Exposure Pathway**

The DOE-SR sportsman exposure pathway is the dose to local hunters and fishermen. This exposure pathway has drawn a considerable amount of attention since 1993 due to the differences in dose exposure noted between onsite and offsite hunters. The sportsman exposure pathway was primarily influenced by the food (hog, deer, fish, and vegetables) and All-Releases (not sportsman related) from the liquid and airborne pathways (WSRC 2007).

Hunter and fisherman maximum potential dose is presented in the Potential Radiation Doses section of the SRS Environmental Reports and Table I1, section 5.1.3 of this report. Figure 5, section 5.1.2 compares the MEI dose from All-releases (atmospheric and liquid) to the hunter and fisherman dose. The MEI dose from All-Releases between the years 1993 - 2006 was not above 1.0 mrem (Figure 5, section 5.1.2). The onsite hunter (usually the highest dose potential) has always had the highest dose potential (8.8-mrem or above). The offsite hunter and offsite fisherman typically have the second and third highest dose to the MEI, respectively. DOE-SR established a 30 mrem limit for the consumption of game animals in 2006. No single pathway should contribute more than 30 percent of the 100 mrem DOE dose limit. All three of the sportsman doses were greater than the All-Pathway dose (Table I1). The soil and sediment exposure component was potentially a significant contributor to dose for the hunter and fisherman due to external exposure, and incidental ingestion and inhalation of resuspended soil.

The dose from the sportsman pathway was largely influenced by Cs-137 uptake in the SRS deer population. Other radionuclides such as Sr-90, Sr-89/90, Ra-226 and Ra-228 also exceed the SRS benchmark values for the onsite recreational hunter (WSRC 2000c). Radionuclides found in deer harvested onsite may be passed on to local hunters. Deer harvested onsite were monitored by SRS personnel before the harvested animal left the SRS. SRS personnel also calculated the cumulative annual dose for each individual hunter for the animals they harvested throughout the year. Data collection from SRS deer and hog hunts resulted in the detection of Cs-137 averaging 2.651 pCi/g in deer and 3.19 pCi/g in hogs (WSRC 2007). The average Cs-137 concentration in turkeys was 1 pCi/g.

Refer to section 5.1.4 for the food dose averages, standard deviation, and medians.
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## CDC DOSE RECONSTRUCTION, DOE-SR REPORTS, AND SCDHEC DATA PROJECTIONS

### The CDC Dose Reconstruction Report

The Phase III "Draft for Public Comment" SRS Dose Reconstruction Report (CDC 2004) made important recommendations based on analysis of various scenarios for critical pathway assessments. This report attempted to address the public health consequences of SRS operations to children born in 1955 and 1964 for the 39-year period since plant operations began.

The CDC designed the Dose Reconstruction project to take place in five phases. The project included input from open public participation, Citizen Advisory Boards, and the SRS Health Effects Subcommittee (SRSHES). These committees reflect the diversity of the communities and make

recommendations to SRS and the CDC. The SRSHES advised the CDC on the adequacy of their health research and public health activities associated with the SRS Dose Reconstruction Project.

Phase I (completed 1995) copied documents, established an electronic database, and described SRS areas and processes. Phase II (completed 2001) included source term development, and pathway analysis up to 1992 that resulted in a 1400 page report entitled, " Savannah River Site Environmental Dose Reconstruction Project, Phase II: Source Term Calculation and Ingestion Pathway Data Retrieval, Evaluation of materials Released from the Savannah River Site (Phase II)".

In the Phase III "Draft for Public Comment" (CDC 2004), the CDC intended to use the International Atomic Energy Agency Safety Series Report No. 19 for a screening analysis of SRS. The purpose was to determine what radiological releases might have biological significance and warrant further investigation in Phases III and IV. Phase III level 1 screening was for all pathways, and level 2 screening was for each individual pathway. The CDC revised their approach to include seven hypothetical sets of individuals performing realistic and extreme activities on and near the SRS. The scenarios included families that lived and worked in the SRS area, while bearing children and engaging in radiation exposure activities during the years of SRS releases. The MEI sportsman living in the swamps downriver was not a scenario addressed by the CDC study. However, the outdoors family and near river family studies incorporated some of the same elements (fish consumption). The SCDHEC and SRS environmental reports highlight the importance of external exposure during game animal harvesting, especially deer and hogs, and game animal consumption to the overall dose to the MEI.

The conclusions of the "Draft for Public Comment" (CDC 2004) phase III SRS Dose Reconstruction Report study are quoted as follows:

1. Doses and risks are small for all receptors and scenarios relative to doses and risks from background radiation over the 39-year period of the study.
2. For people who ate fish from the Savannah River or Lower Three Runs creek, fish ingestion was the most significant pathway, and the most important radionuclides were generally cesium-137, phosphorus-32, and strontium-90.

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3. For people who did not eat fish from bodies of water contaminated by releases of radionuclides to water, milk and beef were the most significant pathways and iodine-131 and tritium were the most important radionuclides.
4. Immersion in argon-41 was a significant, generally small, but constant contributor to dose.
5. Large doses occurred in years corresponding to large releases from the Savannah River Site especially iodine-131; for the Adult Male, Adult Female, and Child Born in 1955, and a large fraction of the total dose was received during the years 1955-1961.
6. There were important differences in doses, pathway significance, and radionuclide significance between children born in 1955 and children born in 1964. Those born in 1955 experienced the large iodine releases early in the site history, while those born in 1964 did not experience them.
7. Doses caused by ingesting fish from Lower Three Runs creek were significant and higher than doses caused by ingesting fish from the Savannah River.
8. For air releases, the variations in air dispersion of radionuclides from the SRS generally produced a significant, but not dominant, variation in estimated doses.
9. Consideration of uncertainty in the variables used to estimate doses could cause an estimated dose to be higher or lower than the corresponding point-estimate result. The mean of the distribution of total dose for any receptor ranged between 2.15 to 1.07 times the corresponding point-estimate dose; thus, the means of the uncertain doses were close to the corresponding point –estimate values.
10. The use of hypothetical scenarios to demonstrate the interactions of a range of receptor behaviors with the site and release characteristics was an effective analytical tool.

The largest point-estimate dose for the hypothetical receptors was 0.94-rem (940-mrem) over the 39-year period for the Outdoor Family Child born in 1955. The annual average radiation background exposure for the general U. S. population would result in 14 rem of dose (360-mrem times 39-years) from NORM and medical sources during the same 39-year period. Thus, the 39-year average from background sources not associated with the SRS was 14.9 times greater than the CDC point estimate dose from SRS operations during that study period. The statistical uncertainties meant that a newborn mean dose (1955 maximum dose) of 1.3 rem with a median of 1.1 rem for the 39-year period was possible. The maximum dose was 6-rem and the minimum was 0.25-rem**.** Consideration of these uncertainties would change the range comparison for background to dose from approximately 2.33:1(14:6 mrem) for the maximum, to 56:1 (14:0.25 mrem) for the minimum dose exposure. That is, the average annual background was at least 2.33 times greater than the maximum 39-yr SRS dose observed for the CDC scenarios. The corresponding risk of cancer incidence was 0.10 percent to 0.024 percent for cancer fatality (CDC 2004).

## Evaluation of SCDHEC, DOE-SR, and CDC Dose Results and Projections

The purpose of the following comparisons and projections was to evaluate how future expected dose will compare to past dose estimates. These CDC scenarios represent risk to the local population born during either 1955 or 1964. The relevant pathways over the CDC 39-year period were fish (produced 50% of the ingestion dose for 8 of 12 receptor scenarios, and 83% of

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the dose for 10 of 12 receptors), and beef (highest % for the remaining two scenarios) for the scenarios exposed to water releases (CDC 2004). The percent of total MEI media ESOP dose detections from 1999-2006 indicated that fish dose was approximately 4.13 % and deer was 65.66 % (Table 3, section 5.1.4). The greatest contributors to dose during the CDC 39-year period for the fish and beef pathways were Cs-137, Sr-90, P-32, and I-131. The SCDHEC data for the period 1999-2006, including possible NORM above background, indicated that the primary contributors to dose (>1% of dose) were Cs-137, beta-gamma, alpha, Ra-226, Sr-89/90, tritium, and Ac-228. Since the SRS nuclear reactors were shut down in 1988, except for a test run of K reactor in 1992 (WSRC 1999c), any reactor-released radionuclide with a half-life less than 1.8 years was no longer relevant in 2006. It takes ten half-lives to reduce the radionuclide concentration to less than 0.1%. Thus, P-32 (14.29 day half-lives) and I-131 (8.04 day half-lives), which were major contributors to dose during the CDC study, were no longer of concern. However, Cs-137 (half-lives 30.17-years) and Sr-90 (half-lives 28.60-years), and some long-lived daughter products of other radionuclides will continue to be sources of dose during a future 39-year period.

The contributions to dose for the air pathway were greatest from milk and beef for over 75% of the critical pathway scenarios. The major contributors to air dose for these scenarios were I-131 and tritium. Due to the complete shutdown of all SRS reactors by 1992, I-131 is no longer a factor due to its short half-life (8.04–days). Only tritium is of concern for the public and the environmental air dose today since it continues to be released both by the SRS and Plant Vogtle, and its half-life is 12.28 years. Argon-41, produced only during reactor operation, with a half-life of 1.83-hours, was only relevant as an air immersion dose the same day of release. The air dose was approximately 10% of the dose for the cumulative MEI (CDC 2004).

The absence of P-32 and I-131 dose in the water pathway, and I-131 and Ar-41 in the air release pathways, should result in reduced exposure to activity that contributes to dose for today's life-style scenarios. Compare the CDC scenario dose calculations of 1300 mrem (range 250 mrem to 6000 mrem) total dose for the radionuclides of significance during the reactor period of operation at SRS to the projected average dose for a future 39-year period based on extrapolated 2002-2006 DOE-SR and SCDHEC Sportsman MEI dose estimates (Table 1, section 5.1.2). The 2002-2006 DOE-SR dose estimates and the 2002-2006 SCDHEC detections were totaled, averaged, and multiplied by 39 years to project a dose average exposure for the SCDHEC sportsman MEI. This 39-yr future dose average estimate (2002-2040) was compared to the previous 39-year CDC scenario maximum estimates (1954-1992) as worst-case scenarios. Note that this comparison projects a five year average dose over a 39-yr period based on 5 years of recent data (2002-2006). ESOP sampling for the period 2002 through 2006 detected 86.79 % of the DOE-SR dose estimate (Table 1, section 5.1.2).

The SCDHEC projected offsite average dose estimate for 2002 to 2040, based on a five-year average detection level for the sportsman MEI dose media, would be 597.95 mrem. The DOE-SR Sportsman MEI based on the SRS Environmental Reports from 2002-2006 would give a projected minimum 39-year average exposure of 688.97 mrem (Table 1, section 5.1.2). These two dose average estimates of the offsite dose total for a future 39- year period were near the low end of the CDC 1955/1964 scenarios dose range (250 mrem to 6000 mrem) for a previous 39-

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year period that included operating reactors. The SRS onsite hunter 39-year average dose projection would be 1222.26 mrem (Table 1, section 5.1.2). If this dose was added to both the SCDHEC (597.95) and the DOE-SR sportsman (688.97) off-SRS 39-year dose, then the potential 39 year dose for the hunter who killed deer on and offsite would be 1820.21 mrem and 1911.23 mrem, respectively. This dose range prediction of 1820.21 mrem to 1911.23 mrem of exposure over the next 39-year period (2002 to 2041) for the combined on-SRS and off-SRS MEI sportsman scenario is low compared to the highest estimate that occurred in 2004, 2244 to 2384 mrem (SCDHEC 2005a). Thus, the 39-year projected dose is expected to continue to drop in future years as new data is added due to radionuclide half-life decay, if the SRS production levels continue to drop. However, the total dose for the sportsman 39-year MEI would accumulate on a yearly total basis and not on an average basis. That is, a future dose to the individual will result from the total of all exposures and not the average. The trend line is uncertain for the future dose scenario due to possible changes in the future DOE-SR mission.

Extrapolation of DOE-SR and SCDHEC recent dose data to an average dose over a future 39-year period indicated a wide range of possible dose exposures to the MEI sportsman that were primarily dependent on whether the sportsman consumed deer and/or hogs from onsite and/or offsite. The CDC point estimate uncertainty maximum of 2.15 allows for the possibility of this dose reaching 2021-mrem (2.15 times 940-mrem), which was greater than the 1820.21 mrem SCDHEC estimate and the DOE-SR 1911.23 mrem estimate for the onsite hunter. Thus, the CDC scenarios uncertainty range, despite not accounting for onsite deer, seemed to allow for the onsite sportsman exposure (i.e., 2021>1820.21).

Also, compare the CDC uncertainty upper limit (2021 mrem) for a past 39-year period to the Table 1, section 5.1.2 estimates for future 39-year data projections from SRS data (1911.23 mrem) and from SCDHEC data that added onsite deer (1820.21 mrem). The average of the SRS and SCDHEC 39-year projections (1865.72) for the sportsman indicated a possible addition of 13.29 percent ((1865.72/14040)*100) to the 39-yr NORM plus medical dose for this worst-case scenario.

The CDC estimate included specific radionuclides that are no longer of concern and not part of the ESOP projection estimate (reactor operations have ceased). Note that the worst-case scenario projected range (1820.21 mrem to 1911.23 mrem) using comparable DOE-SR and SCDHEC data from 2002 through 2006 to make a 39-year projection, was far less than the maximum possible dose (6000 mrem, CDC 2004) for the child born in 1955. Thus, the transport of potential dose to the public through onsite hunting has declined as expected due to reduced operations at the DOE-SR and decay factors for the relevant radionuclides. Also, this extrapolation of potential dose totals for a future 39- year period gave results less than the 30-year committed dose standard of DOE (3000 mrem, WSRC 2007), and has decreased compared to a previous 39-year period (CDC estimate).

The 39-year CDC maximum point estimate offsite dose of 940-mrem was greater than the SCDHEC average, and DOE-SR offsite projection range estimates of 597.95-mrem to 688.97-mrem respectively (Table 1, section 5.1.2). The DOE-SR calculated data models were very conservative and expected to produce a greater dose than the SCDHEC actual radionuclide detections in the environment. However, the SCDHEC Sportsman MEI scenario does use

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a few more conservative exposure rates for observed data than the site-specific calculations used by DOE-SR. These different approaches still resulted in the SCDHEC detected dose assessed as less than the DOE-SR calculated dose and served to confirm that the DOE-SR and CDC dose estimates were conservative. Reduced future offsite exposure was expected since the major dose contributors (I-131, Ar-41, and P-32) associated with reactor operations and processing were no longer dominant factors. The addition of an onsite sportsman dose estimate to the Outdoor Family Child and River Dweller CDC scenario would have increased the dose estimates for the past 39-yr periods considered by the CDC, but would be within the CDC scenarios uncertainty range.

The maximum dose exposure to the sportsman MEI occurred with the onsite hunter, the offsite sportsman, and the creek mouth fisherman in that order. The SCDHEC detections in the air and liquid dose pathways excluding the Sportsman dose from 2002 to 2006 were only 0.33 % of the total dose (0.25/76.66*100) for the offsite sportsman. The general public scenario, based on a three standard deviation maximum of the Table 2, section 5.1.2 data, would receive 19.11 mrem of dose (0.13+3*0.12)*39) over the next 39-year period or 1.05 % of the projected onsite and offsite hunter dose ((19.11/1820.21)*100).

**CONCLUSIONS AND RECOMMENDATIONS**

Based on ESOP actual field detections, the DOE-SR MAXDOSE-SR release estimates did not result in an equivalent depositional dose in actual media samples. This was expected since weather factors play a major role in atmospheric depositions and actual dose exposure. Also, the liquid pathway collective dose estimates performed by DOE-SR did not equal actual detections, possibly due to depositional factors in SRS streams that determined whether many radionuclides were transported off-SRS and resulted in a dose to the public. The 2006 SCDHEC MEI dose pathway detections included direct exposure sources (41.86%) with probable NORM, total ingestion for all drinking water sources (18.49%), food ingestion (27.37%), and air inhalation (12.28%). If the probable NORM detections were excluded then the pathway percentages changed to 56.12% of detected dose from direct sources, 43.65% of dose from combined ingestion sources (water and food), and 0.22% from inhalation. The SCDHEC 2006 detected dose is compared to the 1999-2006 average, and four SCDHEC conservative scenarios for public exposure to radionuclides were developed and summarized (Table 2, section 5.1.2). Fluctuations in yearly dose and the limited number of samples in any given year indicated that the 1999-2006 averages and medians reflect a more accurate picture of dose trends (Table 3, section 5.1.4,). The median may be a more accurate center point determination when the number of samples is sufficiently large, which is indicated when the average and median are approximately the same. Thus, the farmer scenario dose appeared to be the most uncertain, possibly due to the influence of NORM on the soil and groundwater media dose.

The 2006 public dose, farmer dose, and average sportsman dose indicated an increase above the eight year average due to an increase in sampling and types of samples since 2004, and improved background sampling. However, the 2006 MEI Sportsman dose was only one-third of the 1999-2006 MEI sportsman average, due primarily to a drop in the deer Cs-137 dose.
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Radiation contributing more than 1 percent of the SCDHEC average detected dose including probable NORM for the 1999-2006 period included: Cs-137 (42.39%), beta-gamma (20.97%), alpha (17.45%), Ra-226 (11.10%), tritium (1.82%), Sr-89/90 (1.37%), and Ac-228 (1.09%). The SRS Environmental Reports and SCDHEC assigned unspecified alpha and beta concentrations to Pu-239, and Sr-90, respectively. The alpha- and beta-emitting radionuclides contributed substantial unspecified dose based on the Pu-239 and Sr-90 dose factors. Therefore, Pu-239 and Sr-90 doses were potentially inflated due to the incorporation of the dose from naturally occurring alpha- and beta-emitters. Also, some naturally occurring NORM above background may reflect local soil characteristics rather than contributions from the SRS. Possible NORM were assumed of SRS origin if above the South Carolina yearly average background for the media. Probable NORM determinations resulted from the lack of unsubstantiated dose in other samples. For example, potential soil resuspension dose calculations were not supported by air monitoring station detections. Also, groundwater detections above the SRS were assumed to be NORM originating from upgradient saprolite due to half-life considerations in combination with recharge area locations and groundwater travel rates.

The SCDHEC radionuclide detections from 1999 through 2006 excluding probable NORM included: Cs-137 (42.39%), tritium (1.82%), Sr-89/90 (1.37%), Sr-89 (0.58%), U-234 (0.46%), Eu-155 (0.37%), Zn-65 (0.23%), U-238 (0.19%), U-235 (0.08%), Sr-90 (0.04%), Ce-144 (0.01%), Am-243 (0.01%), Pu-239/240 (0.01%), and other radionuclides of less than 0.005%. Other radionuclides were not detected at significant figure dose or were not greater than the average South Carolina background.

The SRS Environmental Report for 2006 report calculated the external exposure, ingestion, and inhalation routes of public exposure to radionuclides (WSRC 2007, Table 6-4). The DOE-SR onsite game animal, and ESOP offsite game animal, fish, and direct external radiation exposure pathways were the primary contributors to dose. Ingestion of foods such as offsite game animals, fish, vegetation, and drinking surface water were important contributors to the sportsman's potential dose (Table 3, section 5.1.4). Although highly variable, the potential dose involving game animal radionuclide concentrations tends to be greater than the fish exposure from year to year. Other exposure dose becomes more important as game animal dose declines. The high Cs-137 bioconcentration factor for fungi correlated with fungal growth factors may be one source of Cs-137 dose variability in deer (Du Pont 1983). Radionuclides released into the atmospheric and liquid pathways also provided a significant dose to other exposure pathways. The primary source of radiological exposure today is presently provided through the sportsman dose scenario or consumption of game animals and fish. The potential sportsman dose received by onsite and offsite hunters, and offsite fishermen from 1993 through 2006 was greater than all other exposure pathways combined (WSRC reports). This potential dose dominance by the sportsman food pathway is substantiated by the ESOP field data dose estimates. Both the SCDHEC and DOE-SR air and liquid dose detections and estimates were less than the DOE and EPA dose limits.

A higher onsite dose and SCDHEC projected 39-year exposure for the sportsman indicated that long-lived radionuclides still present in and around the SRS will play a major role in determining dose exposure to the sportsman, the public, and the environment in the future. The SCDHEC 39

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year projected sportsman scenario offsite estimates of 597.95 mrem (from SCDHEC data) and 688.97 mrem (from DOE-SR data) are less than the CDC scenario closest point estimate (940-mrem) for a previous 39-year period. The SCDHEC projection from actual detections was expected to be less than the very conservative DOE-SR dose estimates. The projected dose for a future 39-yr period would be expected to be less than the CDC past 39-yr estimate when nuclear reactors were in operation at SRS. The SCDHEC estimate is entirely from observed data, but assumed more conservative consumption rates for some media. Actual SCDHEC dose detections were less than the DOE-SR and CDC projections that involved modeling and very conservative assumptions. Also, this extrapolation of potential dose totals for a future 39-year period (597.95 mrem) gave results less than the 30-year committed dose standard of DOE (3000 mrem), and has decreased compared to a previous 39-year period (CDC) point estimate (940 mrem).

Note that two standard deviations (Table 2, section 5.1.2) added onto the ESOP MEI (worst case scenario) result in a possible dose average of 35.35 mrem from 1999 to 2006. Also, a potential dose addition based on DOE-SR onsite hunter (22 mrem) and offsite feral hogs (8.9 mrem) (WSRC 2007, Table 6-4) added to the offsite SCDHEC nonNORM detected dose (4.49 mrem) would increase the potential onsite plus offsite dose estimate to 35.39 mrem in 2006. Thus, two standard deviations added to the average appears to account for additional dose from onsite animals not sampled by ESOP. The additional dose potential and two-standard deviation MEI dose were in agreement and well under the DOE standard of 100-mrem.

Potential atmospheric and liquid release scenarios that may increase the dose to the surrounding public may include the following:

- releases of Am-241, plutonium and uranium radionuclides from Mixed-Oxide Fuel Fabrication Facility through the air and surface water environmental mediums (Duke, COGEMA, Stone, & Webster 1998);
- computer models predict a high concentration of tritium migrating from the old radioactive waste burial ground (ORWBG) to Upper Three Runs (WSRC 2001a) and/or the Savannah River;
- radionuclides such as C-14, I-129, Np-237 and Tc-99 may be an ORWBG contaminant to monitor in the future because of their long half-lives.

These findings indicated that environmental monitoring programs should focus on the sportsman food, swamp sediments and soil (direct exposure, ingestion, and resuspension), other food, drinking water, and air exposure pathways. The down-gradient wells, surface water, sediments, plants, and animals should be carefully monitored for any signs of the contaminants that are present at tank farms, basins and seepage areas. Early detection is paramount to protecting the public and the environment if a release to offsite streams or groundwater occurs. Increased background and SRS perimeter sampling by SCDHEC started in 2004, and should improve the evaluation of background and perimeter concentrations. SCDHEC will continue to monitor the SRS and adjacent area for the primary radiological and nonradiological contaminants associated with DOE-SR operations.

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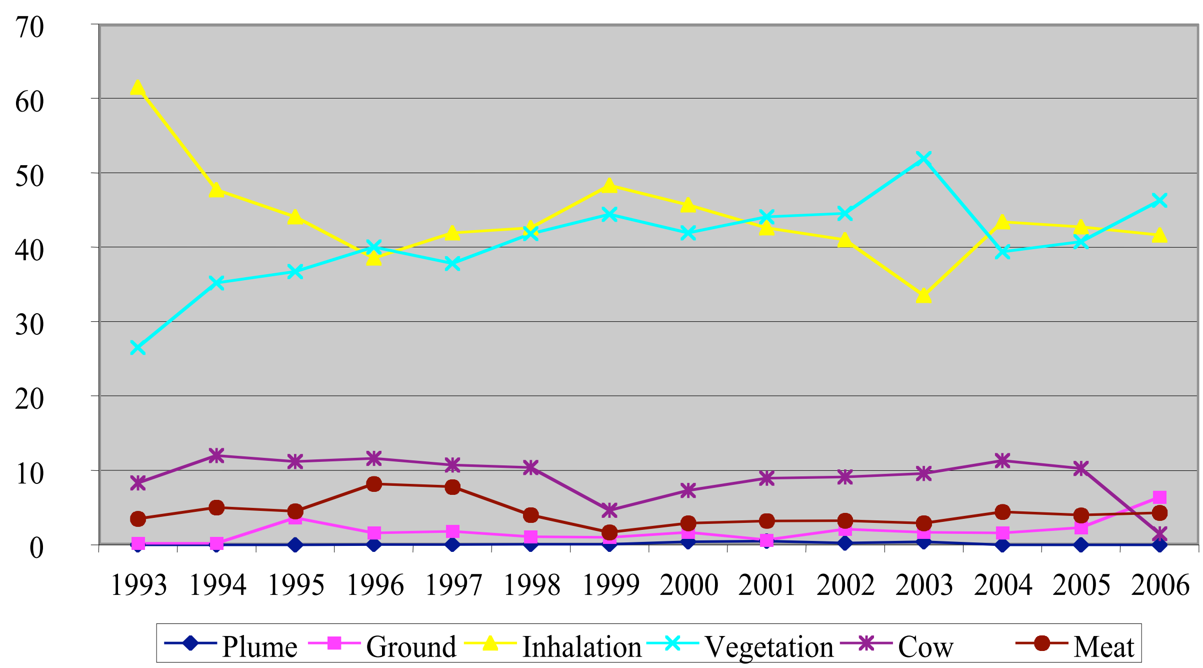
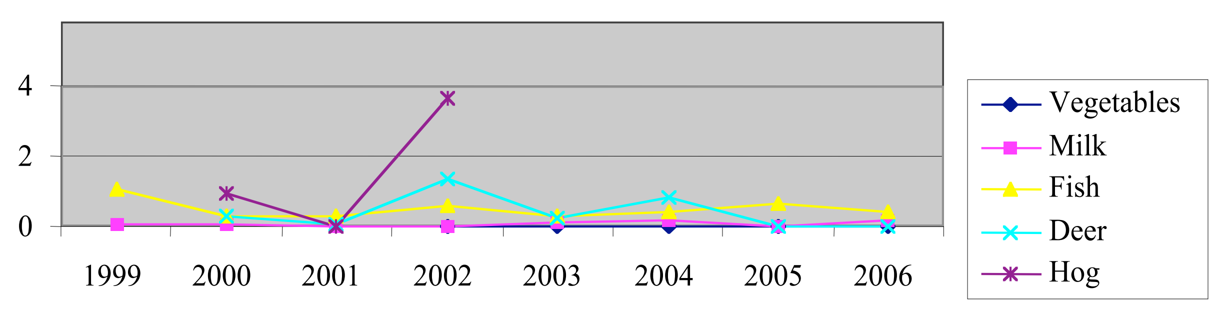
**Figure 1. SRS Potential Percent of Yearly Dose to the MEI from SRS Atmospheric Releases**




Notes:
1. Data came from the SRS Environmental Reports for 1993-2006.

**Figure 2. ESOP Average Detected Dose (mrem) Trends in Food Sources 1999-2006**




Notes: Data from Section 5.1.4, Table 3.

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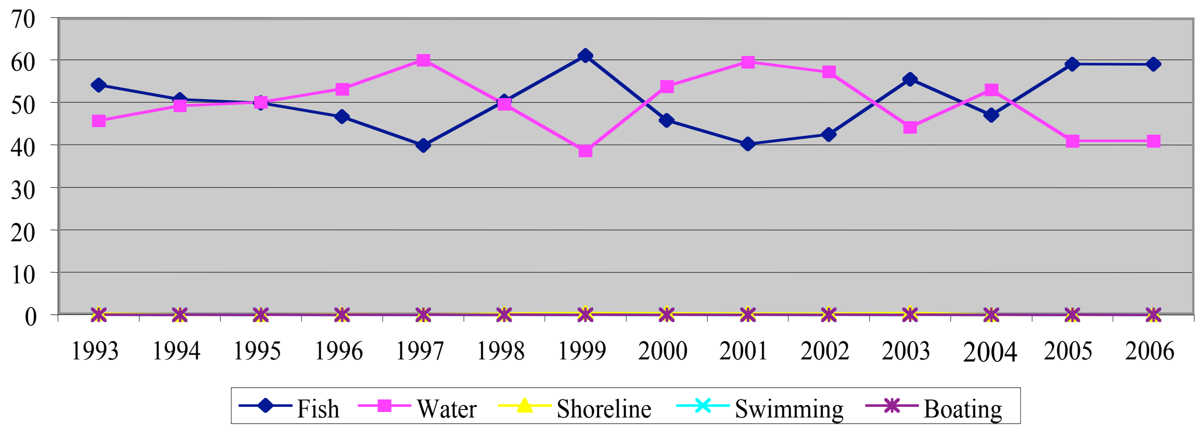
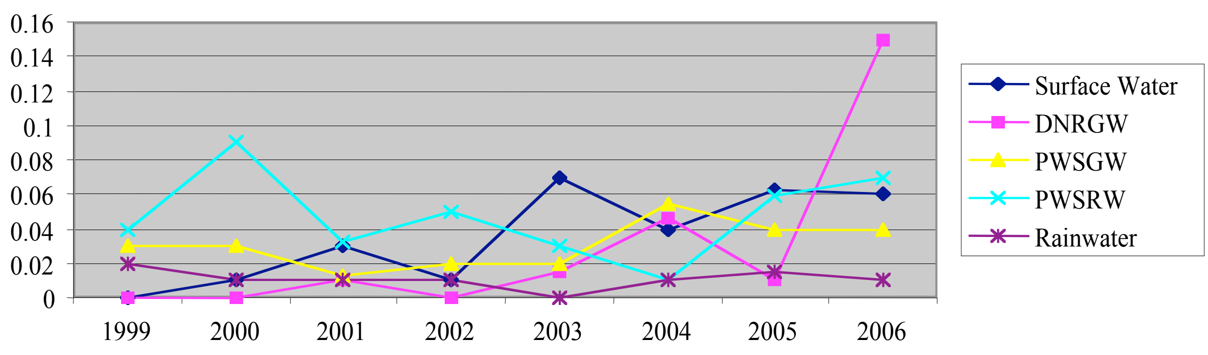
**Figure 3. SRS Potential Percent of Yearly Dose to the MEI from SRS Liquid Releases**




Notes:
1. Data came from the SRS Environmental Reports for 1993-2006.
2. The shoreline, swimming, and boating exposures were less than one percent.

**Figure 4. ESOP Dose (mrem) Trends in Water Sources 1999-2006 Excluding Upgradient Wellwater NORM**




Notes:
1. Data came from the SCDHEC 2006 Dose Calculation Report for the Savannah River Site Perimeter.

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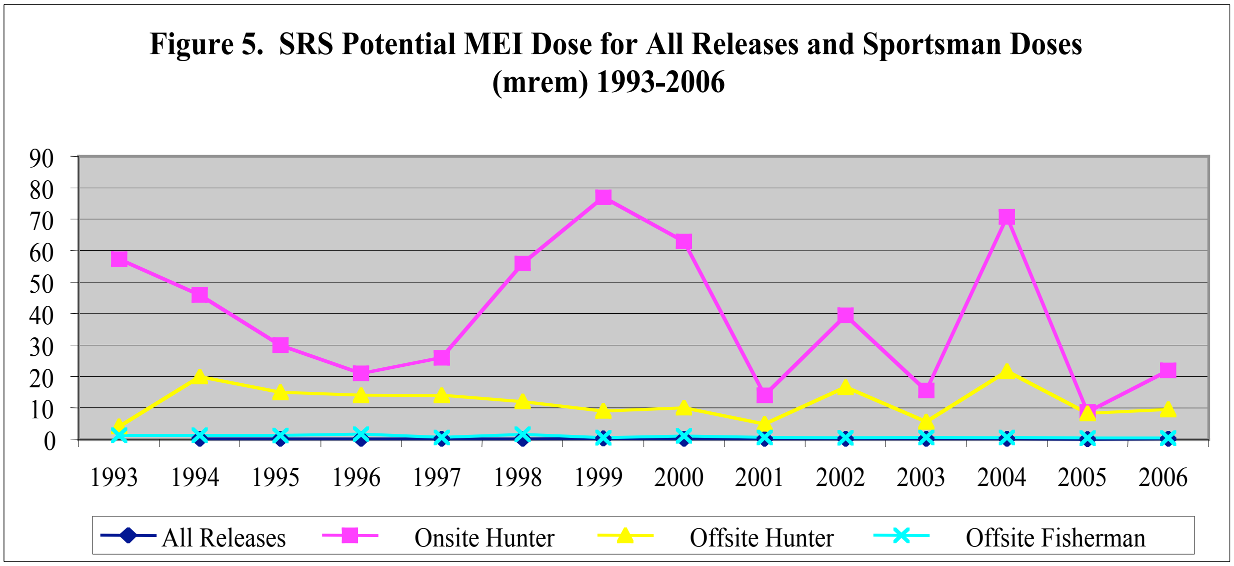


Notes:
1. Data came from the SRS Environmental Reports for 1993-2006.

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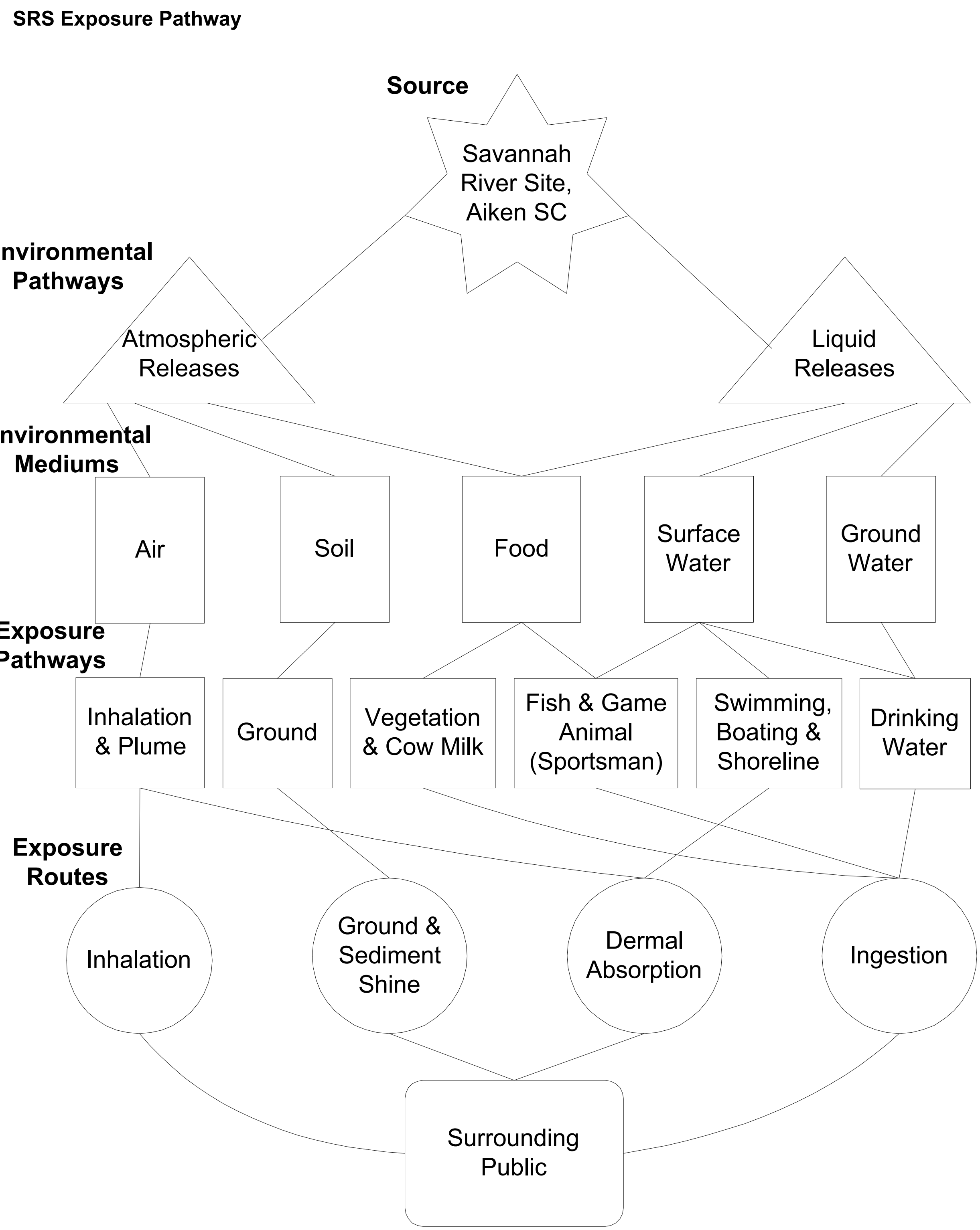
**Figure 6. ESOP Critical Pathway Routes for Dose Analysis of the SRS Perimeter**

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## Critical Pathway

**Table 1. Comparison of 39-year Projections for Dose (mrem) to the MEI Sportsman**

| PATHWAYS | DOE-SR (1) | SCDHEC (2) | CDC (3) Outdoor Family Child | |
|---|---|---|---|---|
| **Dose Totals (mrem)4** | **2002-2006** | **2002-2006** | **Largest Point Estimate and Range** | |
| Air | 0.35 | 0.02 | | |
| Liquid | 0.44 | 0.23 | | |
| Creek Mouth Fisherman | 2.38 | 2.41 | | |
| Fisherman Sediments | 2.18 | 0.00 | | |
| Offsite Deer | 42.80 | 50.36 | | |
| Offsite Soil | 19.00 | 6.69 | | |
| Hog | 21.18 | 16.95 | | |
| Total Offsite Sportsman | 88.33 | 76.66 | | |
| Avg Offsite Sportsman/yr | 17.67 | 15.33 | | |
| Projected 39-yr Offsite Dose | 688.97 | 597.95 | 940.00 | 250-6000 mrem |
| Total Onsite HunterDose | 156.70 | | | |
| Avg Onsite Hunter | 31.34 | | | |
| 39-yr Onsite Hunter | 1222.26 | | | |
| 39-yr Sportsman | **1911.23** | 597.95 | | |
| Adding Onsite Hunter | | **1820.21** | | |

Notes:

1. The DOE-SR data came from the SRS Environmental Report estimates which are totaled and averaged for the sportsman scenario, and utilizes maximum exposure for air and liquid at SRS boundary.
2. The SCDHEC data uses maximum detections (excluding NORM and the DOE-SR onsite hunter.
3. The CDC scenarios largest point estimate dose for a 39-yr study period 1954-1992.
4. All dose is given in millirems (mrem) and is rounded off at 0.005-mrem.
5. Data comparisons limited to the air, river water, hunter-fisherman scenario.

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**Table 2. SCDHEC Potential Dose Scenarios**

| | 2006 | 1999-2006 | | |
|---|---|---|---|---|
| | | Average | Standard Deviation | Median |
| MEI [1] Sportsman | 4.49 | 12.28 | 11.54 | 9.62 |
| Public[2] | 0.37 | 0.13 | 0.12 | 0.09 |
| Farmer [3] | 2.9 | 0.96 | 1.26 | 0.11 |
| Average[4] Sportsman | 3.34 | 2.42 | 1.76 | 2.32 |

Notes: NORM was excluded.

1. The maximum exposed individual (MEI) is the worst-case scenario for a single hunter that also uses the worst-case ingestion dose from all sampled water sources.
2. The non-sportsman public dose deletes sports food, sediments, and soil and adds the highest public or private water source dose.
3. The farmer scenario adds the sediments, soil, and highest well water dose to #2.
4. The average sportsman replaces the MEI deer dose with average deer dose and uses the highest public or private water source dose.

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### 5.1.3 Data
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## Critical Pathway

**Table A1. Savannah River National Laboratory (SRNL) Atmospheric Releases in Curies**

Formerly Savannah River Technology Center (SRTC)

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| **Am-241,243** | 1.34E-06 | 2.75E-07 | | | | | |
| **Cm-242,244** | 6.83E-06 | 3.90E-06 | | | | | |
| **Co-60** | | 6.16E-06 | 2.46E-06 | 8.55E-06 | | 2.65E-07 | |
| **Cs-137** | 1.51E-06 | 2.57E-06 | 2.94E-07 | 1.22E-06 | | 2.30E-06 | |
| **I-131** | 5.92E-05 | 4.77E-05 | 4.07E-05 | 2.98E-05 | 2.98E-05 | 8.29E-06 | 1.01E-05 |
| **I-133** | 1.96E-03 | 1.98E-03 | 1.72E-03 | 5.94E-04 | 4.92E-04 | 1.59E-04 | 1.25E-04 |
| **I-135** | | 2.96E-01 | 7.19E-02 | | | | |
| **Pu-238** | 1.00E-08 | 7.87E-08 | | | | | |
| **Pu-239** | 9.41E-06 | 1.56E-06 | 1.75E-06 | 6.67E-06 | 2.47E-06 | 6.71E-06 | |
| **Sr-89,90** | 1.19E-05 | 2.34E-06 | 7.31E-06 | | | 2.66E-05 | |
| **U-235,238** | 2.89E-08 | 3.94E-08 | | | | | |
| **Xe-135** | 3.19E-02 | 2.17E-02 | 1.49E-02 | 1.20E-03 | | | |
| **Alpha** | | | | | | | 1.75E-06 |
| **Beta-Gamma** | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| **Cs-137** | 8.85E-08 | | | | | | |
| **I-131** | 6.96E-06 | 6.13E-06 | 1.24E-05 | 8.38E-07 | | | |
| **I-133** | 1.18E-04 | 4.26E-04 | 1.64E-04 | | | | |
| **Alpha** | 9.16E-07 | 1.49E-08 | | 2.36E-07 | 1.74E-07 | 1.11E-06 | 1.12E-06 |
| **Beta-Gamma** | | | | 1.60E-06 | 6.13E-06 | 1.88E-06 | 3.41E-06 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table A2. Savannah River National Laboratory (SRNL) Liquid Releases in Curies**

Formerly Savannah River Technology Center (SRTC)

| Radionuclide | 1993 * | 1994* | 1995* | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| H-3 (oxide) | 1.29E-01 | 2.27E-01 | 8.84E-01 | 8.78E-01 | 1.82E+00 | 1.52E+00 | 1.46E+00 |
| Pu-238 | | | 7.80E-06 | 6.71E-06 | 1.78E-06 | 1.47E-05 | 7.73E-06 |
| Pu-239 | 2.66E-04 | 5.70E-05 | 6.01E-04 | 3.41E-04 | 3.38E-03 | 4.41E-03 | |
| Sr-89,90 | 2.02E-03 | 1.62E-03 | 1.28E-03 | | 4.10E-03 | 4.24E-03 | |
| Sr-90 | | | | 9.31E-04 | | | |
| U-234 | | | 1.24E-04 | 5.06E-05 | 1.06E-04 | 8.48E-05 | 8.39E-05 |
| U-235 | | | 7.29E-06 | 1.43E-06 | 3.44E-06 | 2.83E-06 | 2.99E-06 |
| U-238 | | | 1.33E-04 | 5.00E-05 | 1.11E-04 | 7.83E-05 | 7.92E-05 |
| Alpha | | | | | | | 5.25E-03 |
| Nonvolatile Beta | | | | | | | 4.63E-03 |
| Beta-Gamma | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| H-3 | 1.18E+00 | 7.94E-01 | 7.75E-01 | 9.35E-01 | 4.23E-01 | 4.95E-01 | 4.70E-01 |
| Pu-238 | 4.17E-06 | 2.92E-06 | 1.89E-06 | 1.84E-06 | | 1.69E-05 | 4.97E-06 |
| Pu-239 | 5.76E-07 | | | | | 1.20E-06 | 2.44E-05 |
| U-234 | 1.31E-04 | 4.28E-05 | 2.00E-04 | 3.37E-04 | 1.17E-04 | 7.59E-05 | 9.02E-05 |
| U-235 | 4.93E-06 | 7.92E-07 | 1.01E-05 | 2.27E-05 | 6.08E-06 | 3.57E-06 | 5.72E-06 |
| U-238 | 1.34E-04 | 4.90E-05 | 1.89E-04 | 3.16E-04 | 1.13E-04 | 6.96E-05 | 8.35E-05 |
| Alpha | 3.57E-03 | 3.09E-03 | 2.72E-03 | 7.19E-03 | 2.56E-03 | 2.61E-03 | 3.94E-03 |
| Nonvolatile Beta | 3.55E-03 | | | | | | |
| Beta-Gamma | | 3.05E-03 | 2.80E-03 | 1.02E-02 | 4.53E-03 | 5.20E-03 | 5.56E-03 |

1. Empty cells indicate no data reported.
2. Includes liquid releases from TNX.

**Back to List of Data Tables** **Back to 5.1.3 Critical Path Data**

## Critical Pathway

**Table B1. Reactor Materials Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| **Am-241** | | | 3.61E-08 | 1.06E-08 | 1.18E-08 | 2.17E-08 | 1.46E-08 |
| **Cm-244** | | | 9.02E-09 | 2.43E-09 | 2.03E-10 | 4.90E-09 | 1.69E-08 |
| **Cs-137** | | | 3.01E-06 | 3.94E-07 | | | 3.36E-07 |
| **Pu-238** | | | 4.40E-09 | 2.23E-09 | 4.41E-09 | 4.76E-08 | 7.16E-09 |
| **Pu-239** | 3.50E-06 | 7.82E-07 | 1.62E-05 | 2.78E-05 | 6.85E-06 | 5.09E-05 | 2.39E-08 |
| **Sr-89,90** | 8.32E-05 | 4.30E-05 | 1.69E-04 | | 4.16E-05 | 5.05E-04 | |
| **Sr-90** | | | | 4.04E-05 | | | |
| **U-232** | | | | | | 1.20E-06 | 1.33E-08 |
| **U-234** | | | 1.73E-06 | 6.81E-06 | 4.02E-06 | 3.39E-05 | 1.41E-05 |
| **U-235** | | | 2.66E-05 | 1.06E-06 | 6.37E-07 | 6.21E-06 | 2.68E-06 |
| **U-235,238** | 1.55E-05 | 1.15E-05 | | | | | 1.07E-05 |
| **U-238** | | | 1.20E-06 | 1.09E-06 | 1.00E+00 | 6.32E-05 | |
| **Alpha** | | | | | | | 7.23E-05 |
| **Nonvolatile Beta** | | | | | | | 1.84E-03 |
| **Beta-Gamma** | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| **Am-241** | | 5.72E-09 | | | | | |
| **Cm-244** | | 2.23E-09 | | | | | |
| **Cs-137** | 3.36E-07 | | | | | | |
| **Pu-238** | 2.29E-08 | 3.67E-09 | | | | | |
| **Pu-239** | 2.39E-08 | 1.37E-08 | | | | | |
| **U-232** | | | | | | | |
| **U-234** | 5.13E-06 | 3.43E-06 | | | | | 5.97E-07 |
| **U-235** | 7.71E-07 | 5.16E-07 | | | | | |
| **U-238** | 5.41E-07 | 4.93E-07 | | | | | 7.51E-07 |
| **Alpha** | 1.28E-05 | | | | | | 6.39E-06 |
| **Nonvolatile Beta** | | | | | | | |
| **Beta-Gamma** | 3.19E-05 | 1.10E-05 | | | | | 1.94E-04 |

**Back to List of Data Tables** **Back to 5.1.3 Critical Path Data**

## Critical Pathway

**Table B2. Reactor Materials Liquid Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Am-241 | | | 1.14E-06 | 6.72E-05 | 2.11E-06 | 1.34E-05 | |
| Cm-244 | | | 3.52E-06 | 1.19E-05 | 4.14E-07 | | |
| Pu-238 | | | 2.86E-05 | 4.01E-05 | | 3.19E-06 | |
| Pu-239 | 7.64E-05 | 1.33E-04 | 1.05E-05 | | 1.14E-03 | 2.38E-03 | |
| Sr-89,90 | | | 1.04E-03 | | | 3.25E-03 | |
| U-234 | | | 1.17E-05 | 3.55E-05 | 2.68E-05 | 7.02E-06 | 1.24E-02 |
| U-235 | | | 9.37E-07 | | | 4.17E-06 | |
| U-238 | | | 1.98E-05 | 5.83E-05 | 5.71E-05 | 5.38E-05 | 1.37E-02 |
| Alpha | | | | | | | 3.56E-03 |
| Nonvolatile Beta | | | | | | | 9.97E-04 |
| Beta-Gamma | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Am-241 | | | | | | 3.27E-05 | 2.15E-05 |
| Pu-238 | | 2.85E-05 | | | | 1.48E-05 | 1.25E-05 |
| Pu-239 | | 2.31E-06 | | | | | |
| U-234 | | 3.10E-05 | 4.66E-05 | 2.28E-05 | 2.28E-05 | 9.79E-05 | 1.56E-04 |
| U-235 | | | | | | 1.05E-05 | |
| U-238 | | 3.55E-05 | 5.11E-05 | 1.60E-05 | 1.60E-05 | 1.04E-04 | 2.49E-04 |
| Alpha | | 2.59E-03 | 1.93E-03 | 1.26E-03 | 1.26E-03 | 2.49E-03 | 3.74E-03 |
| Nonvolatile Beta | | | | | | | |
| Beta-Gamma | | 1.73E-04 | 6.09E-04 | 5.18E-04 | 5.18E-04 | 3.23E-03 | 4.56E-03 |

1. Empty cells indicate no data reported.

Back to List of Data Tables Back to 5.1.3 Critical Path Data

## Critical Pathway

**Table C1. Separations Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Am-241 | | | | 1.27E-05 | 1.44E-05 | 3.31E-05 | 3.01E-05 |
| Am-241,243 | 1.42E-04 | 5.59E-05 | 3.04E-05 | | | | |
| C-14 | 1.69E-02 | 3.71E-02 | | 8.11E+00 | 3.10E-02 | 7.01E-02 | 2.50E-02 |
| Ce-144 | | | 2.22E-07 | 6.77E-07 | 4.22E-06 | | |
| Cm-242,244 | 4.96E-05 | 1.22E-05 | 3.39E-06 | | | | |
| Cm-244 | | | | 4.47E-06 | 2.49E-05 | 3.67E-06 | 2.59E-05 |
| Co-57 | | | | 5.76E-09 | 2.07E-07 | | 4.69E-08 |
| Co-60 | 5.89E-09 | | 2.84E-07 | 3.85E-07 | 3.45E-07 | | 1.00E-06 |
| Cs-134 | 1.49E-06 | 8.41E-09 | 3.22E-07 | 1.97E-07 | 1.43E-06 | 2.32E-07 | 5.72E-08 |
| Cs-137 | 5.28E-04 | 1.49E-04 | 5.25E-04 | 4.82E-04 | 4.17E-04 | 3.77E-04 | 8.41E-03 |
| Eu-154 | | | 3.02E-07 | 1.87E-07 | 1.54E-07 | | |
| Eu-155 | | | 7.50E-07 | 8.33E-07 | 4.93E-06 | | |
| H-3 (total) | 1.52E+05 | 1.36E+05 | 8.37E+04 | 4.37E+04 | 5.23E+04 | 5.86E+04 | |
| I-129 | 4.96E-03 | 3.80E-03 | 4.70E-03 | 1.04E-02 | 7.08E-03 | 1.25E-02 | |
| I-131 | 8.89E-05 | 2.19E-05 | 1.29E-05 | 5.74E-05 | 2.91E.05 | 5.29E-05 | |
| Kr-85 | | | | 5.47E+03 | 9.62E+03 | 1.70E+04 | |
| Pu-238 | 1.21E-03 | 1.61E-03 | 5.85E-04 | 4.79E-04 | 3.30E-05 | 1.15E-04 | |
| Pu-239 | 1.06E-03 | 7.55E-04 | 4.04E-04 | 2.65E-04 | 5.12E-05 | 1.12E-04 | |
| Ru-106 | 5.76E-09 | 1.19E-08 | 6.46E-07 | 9.18E-07 | | 1.08E-05 | |
| Sb-124 | | | 1.81E-07 | | | | |
| Sb-125 | | | 9.45E-07 | 2.61E-07 | | 1.79E-07 | |
| Sr-89,90 | 1.88E-03 | 1.58E-03 | 1.59E-03 | | 2.20E-04 | 3.23E-04 | |
| Sr-90 | | | | 4.04E-05 | | | |
| U-234 | | | 1.27E-04 | 2.44E-04 | 8.03E-06 | 2.62E-05 | |
| U-235 | | | | 4.67E-05 | 6.25E-07 | 1.57E-06 | |
| U-235,238 | 1.86E-03 | 2.22E-03 | 1.41E-03 | | | | |
| U-238 | | | | 1.37E-03 | 1.94E-05 | 6.92E-05 | |
| Xe-135 | | | 1.87E-02 | | | 4.95E-02 | |
| Zn-65 | | 4.44E-06 | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Am-241 | 2.19E-05 | 1.52E-04 | 2.68E-05 | 2.85E-05 | 1.90E-05 | 7.48E-06 | 1.40E-05 |
| C-14 | 1.33E-01 | 1.70E-01 | 9.00E-02 | 5.00E-01 | | | |
| Cm-244 | 1.49E-05 | 3.90E-06 | 3.44E-06 | 6.62E-06 | 5.36E-06 | 1.69E-06 | |
| Co-57 | 3.26E-07 | | | | | | |
| Co-60 | 1.78E-06 | 4.40E-08 | 1.77E-06 | 3.05E-06 | | | |
| Cs-134 | 2.38E-08 | 1.94E-08 | | | | | |
| Cs-137 | 6.07E-03 | 1.18E-03 | 5.51E-04 | | 1.26E-04 | 8.00E-05 | 1.40E-05 |
| Eu-154 | 1.31E-06 | | | 4.32E-06 | | | |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table C2. Separations Atmospheric Releases in Curies - continued**

| Radionuclide | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| **Eu-155** | | 3.34E-06 | | | | | | |
| **H-3 (total)** | 4.79E+04 | 4.11E+04 | 4.44E+04 | 4.38E+04 | 4.65E+04 | 5.11E+04 | | 2.49E+04 |
| **I-129** | 4.77E-03 | | 1.29E-02 | 1.69E-02 | | 9.41E-03 | | 4.19E-03 |
| **I-131** | | | 2.05E-06 | | | | | |
| **Kr-85** | 3.74E+04 | 5.28E+04 | 6.47E+04 | 3.15E+04 | 6.30E+04 | | | |
| **Pu-238** | 5.27E-04 | 2.83E-04 | 9.15E-05 | 4.25E-05 | 4.11E-05 | 2.09E-05 | 9.62E-06 | 6.94E-06 |
| **Pu-239** | 1.34E-04 | 1.88E-04 | 2.62E-04 | 8.01E-05 | 4.36E-04 | 1.69E-04 | 4.79E-05 | 9.19E-05 |
| **Sr-89,90** | 3.11E-04 | 1.74E-04 | | | | | | |
| **Sr-90** | | | 1.42E-04 | 1.93E-04 | 1.92E-04 | 1.12E-04 | 4.01E-05 | |
| **U-234** | 2.02E-05 | 3.35E-05 | 3.85E-05 | 2.55E-05 | 5.09E-05 | 4.39E-05 | 1.59E-05 | |
| **U-235** | 1.34E-06 | 2.84E-06 | 3.91E-06 | 2.07E-06 | 4.69E-06 | 3.06E-06 | 2.31E-06 | |
| **U-238** | 3.61E-05 | 7.29E-05 | 9.33E-05 | 6.43E-05 | 3.50E-04 | 1.09E-04 | 3.12E-05 | |
| **Xe-135** | 1.94E-02 | | | | | | | |
| **Alpha** | 4.46E-05 | 5.83E-05 | 3.69E-05 | 4.02E-04 | 8.04E-04 | 1.88E-05 | 6.35E-06 | |
| **Nonvolatile Beta** | 3.27E-04 | | | | | | | |
| **Beta-Gamma** | | 1.16E-04 | 1.70E-04 | 2.34E-04 | 4.16E-04 | 1.17E-03 | 3.52E-04 | |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table C3. Separations Liquid Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Am-241 | | | 8.60E-07 | 4.03E-06 | 7.81E-06 | 3.93E-06 | 1.83E-06 |
| Cm-244 | | | 1.11E-07 | 6.23E-07 | 2.93E-06 | 2.36E-06 | 1.26E-06 |
| Co-60 | | | | | | | 4.94E-04 |
| Cs-134 | | | | | | 1.01E-04 | |
| Cs-137 | 2.33E-01 | 9.35E-02 | 6.55E-02 | 9.35E-02 | 4.49E-02 | 1.82E-01 | 1.02E-01 |
| H-3 | 9.88E+03 | 7.73+03 | 7.83E+03 | 5.81E+03 | 5.24E+03 | 6.73E+03 | 4.68E+03 |
| I-129 | 2.20E-02 | 7.39E-02 | 9.49E-03 | 7.82E-02 | 7.82E-02 | 7.82E-02 | 7.82E-02 |
| Pm-147 | 7.03E-03 | 1.54E-03 | 2.63E-03 | 4.80E-04 | | | |
| Pu-238 | | | 2.48E-06 | 2.61E-03 | 9.57E-04 | 9.80E-04 | 9.98E-05 |
| Pu-239 | 8.65E-03 | 1.32E-02 | 9.57E-03 | 1.52E-02 | 3.39E-02 | 2.77E-02 | 1.97E-06 |
| Sr-89,90 | 2.41E-01 | 1.59E-01 | 1.88E-01 | | 1.40E-01 | 2.70E-01 | 1.20E-01 |
| Sr-90 | | | | 1.21E-01 | | | |
| Tc-99 | | 8.80E-03 | | | | | |
| U-234 | | | 1.03E-05 | 6.90E-03 | 2.30E-02 | 3.99E-02 | 8.60E-02 |
| U-235 | | | | 2.08E-04 | 7.23E-04 | 1.70E-03 | 6.33E-04 |
| U-235,238 | 1.14E-05 | 1.00E-05 | 1.56E-05 | | | | |
| U-238 | | | | 9.59E-03 | 2.57E-02 | 4.78E-02 | 1.08E-02 |
| Alpha | | | | | | | 2.05E-02 |
| Nonvolatile Beta | | | | | | | 2.23E-02 |
| Beta-Gamma | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Am-241 | 5.01E-06 | 1.35E-06 | 4.08E-06 | 1.32E-04 | 4.33E-05 | | 5.47E-05 |
| Cm-244 | 7.01E-06 | 1.22E-06 | 1.97E-06 | 1.05E-04 | 1.52E-05 | | 3.59E-05 |
| Co-60 | 4.94E-04 | | | | | | |
| Cs-137 | 8.79E-02 | 5.80E-02 | 3.56E-02 | 2.10E-01 | 6.70E-02 | 1.34E-01 | 8.84E-02 |
| H-3 | 4.09+03 | 3.03E+03 | 1.86E+03 | 2.95E+03 | 1.76E+03 | 1.74E+03 | 1.07E+03 |
| I-129 | 7.82E-02 | 7.82E-02 | 7.82E-02 | 7.82E-02 | 7.82E-02 | 8.00E-03 | 8.31E-03 |
| Pu-238 | 8.12E-06 | 1.36E-05 | 9.57E-06 | 1.50E-04 | 2.13E-04 | | 3.48E-04 |
| Pu-239 | 1.36E-05 | 5.12E-06 | 2.57E-06 | 8.48E-05 | 6.29E-05 | | 2.42E-05 |
| Sr-89,90 | 5.44E-02 | | | | | | |
| Sr-90 | | 2.04E-02 | 3.41E-02 | 9.67E-02 | 9.23E-02 | 3.76E-02 | 3.51E-02 |
| Tc-99 | | 4.56E-02 | 1.94E-02 | | 4.86E-03 | 4.43E-03 | 6.38E-03 |
| U-234 | 2.05E-05 | 2.03E-05 | 2.96E-05 | 3.37E-04 | 1.31E-04 | 3.80E-04 | 4.03E-04 |
| U-235 | 1.20E-06 | 9.05E-07 | 7.94E-07 | 1.63E-06 | 2.66E-06 | 1.27E-05 | 1.93E-05 |
| U-238 | 4.70E-05 | 3.87E-05 | 4.88E-05 | 3.73E-04 | 1.98E-04 | 2.04E-04 | 3.86E-04 |
| Alpha | 1.13E-02 | 1.98E-02 | 1.81E-02 | 2.43E-02 | 8.39E-03 | 9.06E-03 | 2.36E-02 |
| Nonvolatile Beta | | | | | | | |
| Beta-Gamma | 1.92E-02 | 5.63E-02 | 1.94E-02 | 1.01E-01 | 1.93E-02 | 1.12E-02 | 7.56E-03 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table D1. Heavy Water Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| **Co-60** | | | | | | |
| **Cs-137** | | | 2.58E-06 | 1.11E-06 | 2.85E-06 | |
| **H-3 (total)** | 4.48E+02 | 3.01E+02 | 3.28E+02 | 3.29E+02 | 3.53E+02 | 4.04E+02 |
| **Pu-239** | 8.42E-07 | | 2.39E-05 | 6.39E-06 | 2.28E-05 | 2.98E-05 |
| **Sr-89,90** | 7.19E-06 | 1.53E-06 | 1.57E-04 | | 1.83E-04 | 2.61E-04 |
| **Sr-90** | | | | 9.48E-05 | | |
| **Radionuclide** | **1999** | **2001-2006** | | | | |
| **Co-60** | 1.18E-06 | | | | | |
| **H-3 (total)** | 2.31E+02 | | | | | |
| **Alpha** | 1.05E-05 | | | | | |
| **Nonvolatile Beta** | 1.23E-04 | | | | | |

1. Empty cells indicate no data reported.

**Table D2. Heavy Water Liquid Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996* | 1997* | 1998* |
|---|---|---|---|---|---|---|
| **Co-60** | | | 2.28E-03 | | | |
| **H-3 (oxide)** | 4.99E+02 | 2.62E+02 | 6.28E+02 | 1.83E+02 | 4.02E+02 | 3.98E+02 |
| **Pu-238** | | | 1.63E-06 | 1.97E-06 | 7.68E-07 | 2.59E-06 |
| **Pu-239** | | 6.52E-04 | 4.98E-04 | 4.19E-04 | 1.12E-03 | 1.70E-03 |
| **Sr-89,90** | 4.65E-02 | 1.08E-02 | 1.15E-02 | | 5.09E-03 | 3.22E-03 |
| **Sr-90** | | | | 5.38E-03 | | |
| **U-234** | | | 1.63E-06 | 7.45E-07 | 1.52E-06 | 9.20E-06 |
| **U-235** | | | 3.88E-06 | | 1.37E-07 | 4.30E-07 |
| **U-235,238** | | | | 1.75E-06 | | |
| **U-238** | | | | | 9.19E-06 | 2.39E-05 |
| **Radionuclide** | **1999*** | **2000*** | **2001-2006** | | | |
| **H-3 (oxide)** | 2.13E+02 | 1.29E-01 | | | | |
| **Pu-238** | 1.14E-06 | 2.25E-06 | | | | |
| **Pu-239** | | 1.77E-07 | | | | |
| **U-234** | 4.88E-06 | 3.35E-06 | | | | |
| **U-235** | | 5.20E-08 | | | | |
| **U-238** | 1.00E-05 | 4.67E-06 | | | | |
| **Alpha** | 1.04E-03 | 4.93E-04 | | | | |
| **Nonvolatile Beta** | 3.21E-03 | | | | | |
| **Beta-Gamma** | | 1.02E-03 | | | | |

1. Empty cells indicate no data reported.
2. Includes liquid releases from TNX.

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## Critical Pathway

**Table E1. Reactors Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Co-60 | | | 2.78E-05 | | | | |
| Cs-137 | 1.04E-04 | 6.40E-06 | 4.68E-04 | 1.76E-05 | 2.48E-04 | 3.50E-05 | 2.32E-05 |
| H-3 (total) | 3.85E+04 | 2.37E+04 | 1.26E+04 | 1.10E+04 | 5.23E+03 | 2.28E+04 | 3.04E+03 |
| I-131 | | 4.42E-07 | | | | | |
| Pu-239 | 4.11E-06 | 6.33E-07 | 2.78E-04 | 6.74E-05 | 2.92E-04 | 2.19E-04 | |
| Ru-106 | 3.99E-06 | | | | | | |
| Sr-89,90 | 1.81E-04 | 1.08E-04 | 3.29E-03 | | 1.80E-03 | 1.62E-03 | |
| Sr-90 | | | | 1.05E-03 | | | |
| Alpha | | | | | | | 5.09E-04 |
| Nonvolatile Beta | | | | | | | 1.19E-03 |
| Beta-Gamma | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Am-241 | | | 1.68E-08 | 3.52E-08 | 1.04E-07 | 8.63E-08 | |
| Cm-244 | | | | | | 2.55E-08 | |
| Co-60 | | | 3.59E-08 | | | | |
| Cs-137 | 1.22E-05 | | 4.36E-08 | 1.70E-07 | 1.70E-07 | | |
| H-3 (total) | 3.11E+03 | 2.41E+03 | 2.20E+03 | 1.10E+03 | 1.18E+03 | 6.44E+02 | 1.14E+03 |
| I-131 | | | | | | | |
| Pu-238 | | | 2.98E-07 | 1.46E-08 | | | |
| U-234 | | | | 1.62E-07 | | 1.33E-07 | 5.97E-07 |
| U-235 | | | | 2.31E-08 | | | |
| U-238 | | | 1.25E-08 | 5.24E-08 | 1.10E-07 | 8.39E-08 | 7.51E-07 |
| Alpha | 7.65E-05 | 5.49E-05 | 4.72E-05 | 3.39-05 | 1.53E-05 | 7.44E-06 | 6.39E-06 |
| Nonvolatile Beta | | | | | | | |
| Beta-Gamma | 8.31E-04 | 3.81E-04 | 4.08E-04 | 2.68E-04 | 6.27E-04 | 7.09E-05 | 1.94E-04 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table E2. Reactors Liquid Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Cs-137 | 1.29E-02 | 4.72E-02 | 1.76E-04 | 2.30E-02 | 2.86E-03 | 1.16E-02 | 3.24E-04 |
| H-3 | 2.29E+03 | 2.42E+03 | 2.97E+03 | 2.73E+03 | 2.91E+03 | 3.44E+03 | 1.40E+03 |
| Pu-238 | | | | 1.36E-04 | 4.24E-05 | 4.90E-04 | |
| Pu-239 | 5.97E-04 | 3.51E-04 | 4.95E-03 | 1.07E-02 | 1.10E-02 | 1.36E-03 | 9.96E-05 |
| Sr-89,90 | 1.87E-01 | 2.14E-01 | 1.97E-01 | 1.35E-01 | 6.46E-02 | 2.21E-02 | 1.37E-02 |
| U-234 | | | | 1.19E-03 | 4.45E-03 | 6.70E-03 | 3.93E-03 |
| U-235 | | | | 1.81E-05 | 4.91E-05 | 7.16E-05 | 2.50E-04 |
| U-238 | | | | 8.21E-04 | 3.83E-03 | 5.09E-03 | 3.10E-03 |
| Alpha | | | | | | | 6.45E-04 |
| Nonvolatile Beta | | | | | | | 2.40E-02 |
| Beta-Gamma | | | | | | | |
| **Radionuclide** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Am-241 | | | | | | 2.03E-08 | |
| Co-60 | 1.13E-03 | | | | | | |
| Cs-137 | 2.16E-04 | 2.25E-02 | | | 6.56E-04 | 1.91E-04 | 3.07E-04 |
| H-3 | 1.25E+03 | 1.28E+03 | 9.93E+02 | 1.36E+03 | 9.21E+02 | 7.62E+02 | 5.52E+02 |
| Pu-239 | | | | | | | |
| Sr-89,90 | 2.84E-05 | | | | | | |
| Sr-90 | | 5.92E-05 | 4.24E-04 | | 1.73E-05 | | 5.71E-05 |
| U-234 | | | | | | | |
| U-235 | | | | | | | |
| U-238 | | | | | | | |
| Alpha | 1.44E-03 | 3.26E-03 | 1.65E-03 | 3.04E-03 | 2.51E-03 | 2.46E-03 | 5.38E-05 |
| Nonvolatile Beta | | | | | | | |
| Beta-Gamma | 2.01E-02 | 2.56E-02 | 1.81E-02 | 3.42E-02 | 3.14E-02 | 9.98E-03 | 7.56E-03 |

1. Empty cells indicate no data reported.

## Critical Pathway

**Table F1. Diffuse and Fugitive Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| Al-26 | | 3.50E-14 | 1.50E-14 | | | |
| Am-241 | | | 1.81E-16 | 4.20E-07 | 8.70E-07 | 5.75E-06 |
| Am-241, 243 | 8.86E-13 | 8.86E-10 | | | | |
| Am-243 | | | 2.30E-17 | 1.76E-05 | 1.76E-05 | 1.89E-05 |
| Ba-133 | | | | | 3.00E-12 | |
| Be-7 | | 1.50E-13 | | | | |
| C-14 | 4.00E-06 | 3.50E-13 | 9.80E-15 | 5.88E-09 | 1.85E-08 | 9.68E-05 |
| Ca-45 | | 1.00E-15 | | | | |
| Ca-47 | | 1.00E-16 | | | | |
| Cd-109 | | 5.00E-14 | 5.21E-14 | | | |
| Ce-139 | | | 1.00E-16 | | | |
| Ce-141 | | | 5.30E-05 | | | 4.16E-05 |
| Ce-144 | 1.13E-13 | 1.13E-10 | 2.32E-04 | 7.36E-06 | 6.11E-06 | 1.45E-04 |
| Cf-249 | | | | | | 5.27E-16 |
| Cf-251 | | | | | | 2.17E-14 |
| Cl-36 | | 1.00E-15 | | | | |
| Cm-242 | | | 2.03E-16 | 2.03E-16 | 8.19E-12 | 1.58E-07 |
| Cm-242, 244 | 7.33E-12 | 7.32E-09 | | | | |
| Cm-243 | | 1.00E-13 | 4.90E-14 | | | |
| Cm-244 | | | | 1.28E-04 | 1.28E-04 | 1.30E-04 |
| Cm-245 | | | | | 1.88E-12 | 2.08E-13 |
| Cm-246 | | | | | | 9.37E-07 |
| Cm-248 | | 9.20E-18 | 9.20E-18 | | | |
| Co-57 | | 2.50E-14 | 2.50E-14 | | 1.04E-09 | 9.40E-11 |
| Co-58 | | | 2.60E-05 | | 1.67E-12 | 1.27E-04 |
| Co-60 | 3.34E-17 | 1.08E-13 | 2.71E-05 | 4.71E-07 | 9.13E-07 | 1.38E-04 |
| Cr-51 | | | 1.00E-16 | | | 1.21E-04 |
| Cs-134 | 1.40E-17 | 2.01E-13 | 2.98E-05 | 2.49E-15 | 1.21E-09 | 1.31E-04 |
| Cs-137 | 4.33E-11 | 1.08E-08 | 1.40E-02 | 4.33E-03 | 4.19E-03 | 4.89E-03 |
| Eu-152 | | | | | 5.32E-09 | 4.19E-08 |
| Eu-154 | 3.44E-13 | 3.44E-10 | | 6.42E-06 | 6.42E-06 | 5.74E-06 |
| Eu-155 | 1.63E-13 | 1.63E-10 | | 1.66E-06 | 1.66E-06 | 1.10E-06 |
| Fe-55 | | | | | | 3.90E-04 |
| H-3 (total) | 4.31E+01 | 1.31E+02 | 3.32E+01 | 2.23E+02 | 1.53E+02 | 9.31E+02 |
| Hg-203 | | 2.00E-12 | 1.00E-12 | | | |
| I-129 | 6.88E-07 | | | 3.83E-06 | 1.22E-07 | 1.29E-05 |
| I-131 | | | 2.05E-02 | | | |
| Mn-54 | | 1.50E-15 | | | 4.80E-12 | |
| Na-22 | | | | | 1.11E-09 | 7.76E-11 |
| Nb-95 | | | 2.67E-05 | 1.55E-15 | 1.55E-15 | 1.13E-04 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table F2. Diffuse and Fugitive Atmospheric Releases in Curies**

| Radionuclide | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| Ni-59 | | | | 2.51E-08 | 3.24E-10 | 8.33E-13 |
| Ni-63 | 2.00E-07 | 2.06E-13 | 2.00E-13 | | 2.29E-09 | 8.21E-06 |
| Np-237 | | 7.40E-15 | | 4.66E-08 | 1.38E-09 | 1.01E-09 |
| Np-239 | | | | 2.17E-07 | 2.17E-07 | |
| Pa-231 | | | | 1.00E-09 | 1.00E-09 | 1.00E-09 |
| Pa-234 | | | | | 2.26E-10 | |
| Pm-144 | | | | | 1.34E-12 | |
| Pm-147 | | | 7.92E-07 | 6.75E-06 | 1.01E-08 | 9.79E-10 |
| Pu-236 | | 1.90E-17 | | | | |
| Pu-238 | 4.63E-12 | 5.18E-07 | 6.61E-06 | 5.19E-06 | 3.55E-04 | 3.28E-04 |
| Pu-239 | 4.70E-07 | 6.45E-07 | 2.21E-06 | 1.83E-04 | 6.92E-06 | 1.41E-03 |
| Pu-240 | | | | 2.11E-07 | 1.11E-06 | 1.12E-06 |
| Pu-241 | | | | 3.75E-06 | 5.16E-05 | 6.02E-05 |
| Pu-242 | | | | | 3.66E-11 | 1.59E-07 |
| Ra-226 | | | | | 1.24E-08 | 8.64E-06 |
| Ra-228 | | | | | 1.75E-10 | 2.13E-05 |
| Rb-86 | | 2.00E-15 | 2.00E-15 | | | |
| Ru-103 | | | 3.72E-05 | | | 2.26E-05 |
| Ru-106 | 4.96E-12 | 4.97E-09 | 1.80E-04 | 7.00E-02 | 7.00E-02 | 2.26E-05 |
| S-35 | 2.00E-06 | 6.85E-12 | 5.26E-12 | | | |
| Sb-124 | | | | | 3.36E-12 | |
| Sb-125 | 7.27E-15 | 7.27E-12 | 1.19E-04 | 2.28E-04 | 5.93E-07 | 5.27-05 |
| Sc-46 | | 1.00E-16 | | | | |
| Se-75 | | 6.00E-16 | | | | |
| Se-79 | | | | 2.47E-08 | 2.15E-10 | 1.85E-11 |
| Sn-113 | | | 3.80E-16 | | | |
| Sn-126 | | | | 6.79E-09 | 3.36E-15 | 1.29E-13 |
| Sr-85 | | 5.00E-15 | 5.20E-16 | | | |
| Sr-89,90 | 1.11E-04 | 3.75E-04 | 3.03E-04 | | 8.21E-05 | 2.58E-02 |
| Sr-90 | | | | 4.75E-04 | | |
| Tc-99 | | | | 2.65E-08 | 3.61E-08 | 2.82E-05 |
| Th-228 | | | | | 2.15E-10 | 9.44E-06 |
| Th-230 | | | | | 2.03E-10 | 1.02E-05 |
| Th-232 | | | | 1.28E-08 | 1.40E-10 | 7.51E-07 |
| Th-234 | | | | | 2.26E-10 | |
| U-233 | | | | 1.62E-08 | 2.11E-08 | 2.35E-06 |
| U-234 | | | | 2.93E-07 | 1.45E-05 | 1.83E-05 |
| U-235 | | | 1.44E-15 | 4.10E-05 | 4.84E-07 | 2.10E-06 |
| U-235, 238 | 4.74E-05 | 8.12E-06 | | | | |
| U-236 | | | | 5.79E-08 | 4.84E-07 | 2.39E-09 |
| U-238 | | | 2.87E-09 | 1.35E-06 | 3.45E-05 | 5.12E-05 |
| Y-88 | | | 9.10E-16 | | | |
| Zn-65 | | 2.60E-13 | 6.24E-05 | 1.46E-16 | 3.69E-12 | 2.23E-05 |
| Zr-95 | 2.39E-14 | 2.39E-11 | 4.51E-05 | 2.13E-05 | 2.13E-05 | 1.71E-05 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table F3. Diffuse and Fugitive Atmospheric Releases in Curies**

| Radionuclide | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| **Ac-228** | 1.66E-06 | 1.80E-06 | 4.07E-06 | 1.72E-06 | 1.64E-06 | 1.60E-07 | 5.71E-07 | 1.46-04 |
| **Ag-110** | | | | | | | 1.09E-10 | 5.58E-12 |
| **Am-241** | 8.44E-06 | 1.24E-04 | 1.15E-04 | 1.16E-04 | 1.13E-04 | 6.92E-06 | 5.74E-04 | 3.92E-04 |
| **Am-242m** | | | | | | | | 3.14E-08 |
| **Am-243** | 4.28E-06 | 6.02E-06 | 9.90E-07 | 4.84E-08 | 7.95E-06 | 6.27E-08 | 5.58E-08 | 1.85E-07 |
| **Am-244** | | | | | | | 3.33E-10 | |
| **Ar-39** | | 3.30E-05 | | | | | | |
| **Ba-133** | | 5.40E-10 | | | | | | |
| **C-14** | 4.92E-04 | 8.39E-05 | 8.76E-05 | 1.19E-04 | 9.42E-05 | | 1.09E-04 | 9.76E-05 |
| **Cd-109** | | | | | | | 3.04E-06 | |
| **Ce-139** | | | | | | | 4.61E-06 | |
| **Ce-141** | 4.16E-05 | 4.16E-05 | 4.16E-05 | 4.16E-05 | 4.16E-05 | 4.16E-05 | 2.65E-05 | 5.23E-05 |
| **Ce-144** | 1.45E-04 | 1.44E-04 | 1.43E-04 | 3.01E-04 | 1.43E-04 | 1.42E-04 | 9.06E-05 | 4.51E-05 |
| **Cf-251** | | | | | | 4.31E-07 | 4.31E-07 | |
| **Cm-242** | 3.10E-07 | 4.47E-07 | 1.43E-08 | | 2.03E-16 | 2.03E-06 | 2.25E-08 | 6.20E-06 |
| **Cm-243** | | | | 6.23E-07 | 4.92E-07 | 4.92E-07 | 1.39E-04 | 7.58E-04 |
| **Cm-244** | 6.74E-06 | 6.19E-05 | 4.76E-05 | 4.77E-05 | 4.79E-05 | 8.62E-07 | 5.74E-07 | 2.28E-05 |
| **Cm-245** | | 1.04E-13 | 4.18E-07 | | | | 2.94E-08 | 3.07E-06 |
| **Cm-246** | 2.91E-06 | 3.98E-06 | 1.01E-06 | | | | | |
| **Co-57** | 2.01E-04 | 3.61E-10 | | | | 8.34E-10 | 8.18E-08 | 8.34E-10 |
| **Co-58** | 1.27E-04 | 1.27E-04 | 1.27E-04 | 1.27E-04 | 1.27E-04 | 1.27E-04 | 8.11E-05 | 4.03E-05 |
| **Co-60** | 1.28E-04 | 8.58E-04 | 8.59E-04 | 8.58E-04 | 8.57E-04 | 1.30E-04 | 1.06E-04 | 5.90E-05 |
| **Cr-51** | 1.21E-04 | 1.21E-04 | 1.21E-04 | 1.21E-04 | 1.21E-04 | 1.21E-04 | 6.49E-05 | 3.90E-05 |
| **Cs-134** | 1.31E-04 | 1.31E-04 | 1.31E-04 | 1.31E-04 | 1.31E-04 | 1.31E-04 | 8.66E-05 | 4.19E-05 |
| **Cs-135** | | | | | | 2.25E-09 | | 6.99E-05 |
| **Cs-137** | 6.11E-03 | 2.07E-03 | 2.22E-03 | 1.47E-02 | 1.42E-02 | 1.21E-02 | 1.59E-02 | 6.14E-02 |
| **Eu-152** | 1.21E-10 | 4.13E-05 | 4.15E-05 | 4.13E-05 | 4.13E-05 | | 8.68E-08 | 7.13E-08 |
| **Eu-154** | 5.74E-06 | 1.51E-05 | 1.53E-05 | 1.67E-05 | 1.51E-05 | 4.37E-09 | 8.38E-06 | 8.24E-05 |
| **Eu-155** | 1.10E-06 | 6.81E-07 | 7.85E-07 | 8.28E-07 | 6.76E-07 | 3.72E-09 | 8.76E-07 | 4.70E-06 |
| **H-3 (total)** | 4.71E+02 | 6.12E+02 | 6.07E+02 | 1.26E+03 | 2.37E+03 | | 8.67E+03 | 8.60E+03 |
| **Hg-203** | 2.23E-10 | 2.23E-10 | 2.29E-10 | | | | 1.60E-07 | |
| **I-129** | 2.50E-03 | 1.71E-03 | 1.29E-06 | 8.65E-04 | 8.62E-04 | | 4.61E-03 | 4.62E-03 |
| **K-40** | | | | | | 2.76E-08 | 5.61E-07 | 7.55E-05 |
| **Kr-85** | | 2.00E-03 | | 1.19E-04 | | | | |
| **Mn-54** | | 1.30E-10 | 2.52E-08 | | 9.46E-07 | 9.46E-07 | | |
| **Na-22** | | 7.90E-11 | 2.09E-08 | 1.97E-09 | | | 2.31E-08 | 3.39E-07 |
| **Nb-94** | 3.95E-10 | 3.95E-10 | 4.56E-08 | | | | | |
| **Nb-95** | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 7.20E-05 | 3.57E-05 |
| **Ni-59** | 1.02E-09 | 4.17E-13 | | | | 2.06E-08 | 2.08E-08 | 4.14E-05 |
| **Ni-63** | 5.89E-07 | 5.09E-06 | 4.38E-06 | 1.81E-06 | 1.43E-06 | 1.45E-06 | 1.45E-06 | 6.93E-06 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table F4. Diffuse and Fugitive Atmospheric Releases in Curies**

| Radionuclide | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| **Np-237** | 2.23E-10 | 2.26E-10 | 1.09E-08 | 8.50E-09 | | 5.12E-08 | 5.37E-06 | 6.26E-05 |
| **Np-239** | 4.51E-09 | | 1.24E-07 | 7.08E-09 | | 7.79E-09 | 7.79E-09 | 9.21E-08 |
| **Pa-233** | 2.23E-10 | 2.23E-10 | 2.29E-10 | | | | 5.13E-06 | 5.68E-06 |
| **Pa-234** | | | 1.76E-08 | | 4.98E-06 | 7.81E-07 | 8.10E-07 | |
| **Pa-234m** | | | | | | 4.82E-10 | | |
| **Pb-212** | | | | | | 1.03E-09 | 7.49E-07 | 2.17E-04 |
| **Pb-214** | 2.23E-10 | | 6.58E-07 | 6.58E-07 | 1.60E-06 | 9.46E-07 | | 9.29E-07 |
| **Pm-144** | | | | | | 4.05E-13 | | |
| **Pm-147** | 3.49E-09 | 1.30E-05 | 1.34E-05 | 1.30E-05 | 1.30E-05 | 5.35E-15 | 2.27E-05 | 2.79E-05 |
| **Pm-148m** | | | | | | | 1.40E-11 | |
| **Pr-144** | 3.45E-09 | 3.68E-13 | | 1.00E-07 | | | 1.48E-07 | 1.39E-07 |
| **Pr-144m** | | 4.43E-15 | | | | | | |
| **Pu-236** | | | 1.22E-10 | 3.66E-10 | 2.58E-10 | 1.31E-07 | 6.93E-10 | 1.60E-09 |
| **Pu-238** | 1.45E-03 | 7.57E-05 | 3.99E-05 | 5.86E-04 | 2.25E-04 | 3.89E-04 | 7.32E-04 | 1.54E-03 |
| **Pu-239** | 1.68E-05 | 1.86E-03e | 1.94E-03 | 1.90E-03 | 1.91E-03 | 1.09E-04 | 4.03E-04 | 8.04E-04 |
| **Pu-240** | 1.46E-06 | 1.99E-07 | 8.51E-07 | 1.57E-05 | 1.14E-04 | 3.38E-06 | 3.89E-05 | 6.31E-04 |
| **Pu-241** | 6.47E-05 | 4.09E-06 | 6.70E-06 | 1.42E-04 | 4.36E-05 | 8.35E-07 | 1.60E-03 | 2.09E-03 |
| **Pu-242** | 1.53E-08 | 7.03E-09 | 2.09E-08 | 3.98E-06 | 5.25E-08 | 5.90E-08 | 7.15E-08 | 7.84E-04 |
| **Ra-226** | 1.25E-05 | 1.74E-05 | 5.25E-06 | 9.97E-07 | | | 1.01E-06 | 4.18E-05 |
| **Ra-228** | 1.87E-05 | 2.74E-05 | 4.16E-06 | 9.46E-07 | | 1.50E-07 | 3.10E-08 | 1.47E-04 |
| **Rh-106** | | | | | | | 8.81E-08 | 1.11E-08 |
| **Ru-103** | 4.23E-05 | 4.23E-05 | 4.23E-05 | 4.23E-05 | 4.23E-05 | 4.23E-05 | 2.44E-05 | 1.47E-05 |
| **Ru-106** | | 1.04E-05 | 9.92E-07 | 1.04E-03 | 1.40E-06 | 2.18E-08 | 2.90E-07 | 2.09E-07 |
| **Sb-124** | 2.23E-10 | 5.63E-10 | 8.09E-09 | | | 1.54E-08 | 1.54E-08 | 1.54E-08 |
| **Sb-125** | 5.27E-05 | 5.34E-05 | 5.37E-05 | 2.61E-04 | 2.01E-04 | 2.00E-04 | 1.79E-04 | 1.70E-04 |
| **Sb-126** | | | | | | | | 4.37E-05 |
| **Se-79** | | 4.47E-09 | | 1.26E-05 | 9.95E-06 | 1.00E-05 | 1.00E-05 | 1.00E-05 |
| **Sn-113** | | 6.20E-10 | | | | 5.64E-10 | 2.23E-07 | |
| **Sn-123** | | | | | | | 4.91E-11 | |
| **Sn-126** | 3.13E-15 | 6.45E-14 | | | | 3.01E-09 | 1.03E-08 | 4.37E-05 |
| **Sr-89** | 7.02E-04 | 3.72E-03e | | | | 1.62E-06 | 2.50E-06 | 1.90E-06 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table F5. Diffuse and Fugitive Atmospheric Releases in Curies**

| Radionuclide | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| Sr-90 | | | 3.57E-03 | 3.85E-03 | 3.52E-03 | 3.10E-04 | 1.97E-02 | 2.01E-02 |
| Tc-99 | 6.22E-05 | 8.75E-05 | 1.89E-06 | 6.04E-03 | 4.77E-03 | 4.77E-03 | 4.77E-03 | 4.83E-03 |
| Te-127 | | | | | | | 7.66E-11 | |
| Te-129 | | | | | | | 7.74E-12 | |
| Th-228 | 2.75E-07 | 5.76E-07 | 3.97E-06 | | | 9.38E-10 | 5.50E-06 | 2.00E-04 |
| Th-229 | | | | | | 5.77E-09 | | 1.68E-10 |
| Th-230 | 1.22E-05 | 1.74E-05 | 2.71E-06 | | | 5.82E-10 | 1.03E-06 | 1.12E-03 |
| Th-231 | | | | 4.63E-13 | | 4.63E-13 | 4.48E-08 | |
| Th-232 | 1.64E-06 | 2.58E-06 | 1.75E-06 | | | 9.71E-10 | 3.14E-06 | 2.61E-04 |
| Th-234 | 4.10E-06 | 1.04E-04 | 1.03E-04 | 9.98E-05 | 1.04E-04 | 1.08E-06 | 1.25E-06 | 1.22E-06 |
| Tl-208 | | | | | | | | 4.00E-05 |
| U-232 | | | 4.46E-11 | 7.37E-06 | 3.64E-06 | 3.64E-06 | 3.46E-06 | 3.37E-06 |
| U-233 | 2.38E-06 | 1.50E-08 | 3.90E-08 | 4.32E-05 | 3.31E-05 | 3.95E-05 | 4.00E-05 | 5.55E-04 |
| U-234 | 5.29E-05 | 3.59E-04 | 2.84E-04 | 3.31E-04 | 5.18E-04 | 7.99E-04 | 3.37E-05 | 5.94E-04 |
| U-235 | 5.89E-06 | 1.44E-05 | 6.59E-06 | 8.46E-06 | 1.27E-05 | 2.37E-04 | 2.90E-06 | 2.55E-05 |
| U-236 | 5.20E-09 | 4.16E-11 | 7.17E-10 | 3.45E-06 | 2.30E-05 | 3.29E-05 | 1.79E-06 | 3.34E-06 |
| U-237 | | | | | | | | 8.59E-08 |
| U-238 | 9.49E-05 | 4.47E-04 | 3.18E-04 | 3.19E-04 | 1.14E-03 | 7.30E-04 | 1.82E-05 | 2.92E-04 |
| Y-88 | | | | | | | 4.47E-07 | 3.89E-09 |
| Y-91 | | | | | | | 5.89E-09 | |
| Zn-65 | 2.23E-05 | 2.23E-05 | 2.23E-05 | 2.23E-05 | 2.23E-05 | 2.23E-05 | 1.29E-05 | 7.74E-06 |
| Zr-85 | | 1.07E-09 | | | | | | |
| Zr-95 | 1.71E-05 | 1.68E-05 | 1.68E-05 | 1.72E-05 | 1.68E-05 | 1.68E-05 | 1.06E-05 | 5.83E-06 |
| Alpha | 1.47E-03 | 5.86E-04 | 1.33E-03 | 5.47E-04 | 4.15E-04 | 5.70E-04 | 2.60E-04 | 6.01E-03 |
| Nonvolatile Beta | 2.74E-02 | 3.47E-02 | | | | | | |
| Beta-Gamma | | | 3.22E-02 | 2.50E-02 | 2.49E-02 | 2.57E-02 | 1.89E-02 | 1.03E-01 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table G1. Radionuclides that Contribute Greater Than or Equal to 1% to the Total Dose From Atmospheric Releases (Cow Milk Pathway)**

| | % Contribution | | | | | | |
|---|---|---|---|---|---|---|---|
| **Radionuclides** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** |
| **C-14** | | | | 4.3 | | | |
| **Cs-137** | | | 4.4 | 1.5 | 1.6 | 1.2 | 1.3 |
| **H-3** | 89 | 88.0 | 77.5 | 68.0 | 71.3 | 66.8 | 27.8 |
| **I-129** | 2.5 | 2.4 | 4.8 | 11.0 | 8.6 | 10.3 | 4.2 |
| **Pu-238** | 3.1 | 5.0 | 2.8 | 2.3 | 3.0 | 2.1 | 8.2 |
| **Pu-239** | 3.5 | 2.7 | 7.9 | 5.0 | 8.0 | 15.0 | |
| **Ru-106** | | | | 5.0 | 5.5 | | |
| **Sr-90** | | | | | | 3.4 | |
| **U-234** | | | | | | | 1.2 |
| **U-235, 238** | | 1.4 | | | | | |
| **U-238** | | | | 1.1 | | | |
| **Alpha** | | | | | | | 41.6 |
| **Nonvolatile Beta** | | | | | | | 13.5 |
| | | | | | | | |
| **Radionuclides** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| **Am-241** | 1.64 | 1.82 | 1.01 | | | 4.67 | 1.94 |
| **Cm-243** | | | | | | | 2.37 |
| **Cs-137** | 1.90 | | 2.45 | 1.85 | 2.01 | 2.96 | 8.44 |
| **H-3** | 49.53 | 51.24 | 49.67 | 38.8 | 73.93 | 65.82 | 21.45 |
| **I-129** | 3.34 | 15.93 | 17.74 | 33.27 | 9.94 | 9.77 | 6.13 |
| **Pu-238** | 2.53 | | 3.92 | 1.25 | 2.57 | 5.16 | 6.25 |
| **Pu-239** | 22.86 | 15.65 | 13.82 | 12.23 | 1.83 | 3.47 | 4.03 |
| **Pu-240** | | | | | | | 2.86 |
| **PU-242** | | | | | | | 3.37 |
| **Sr-90** | | | | | | 2.17 | 1.57 |
| **Th-230** | | | | | | | 1.99 |
| **Th-232** | | | | | | | 2.34 |
| **U-234** | | | | | 1.08 | | |
| **U-238** | | | | 1.29 | | | |
| **Alpha** | 7.78 | 8.93 | 6.51 | 6.12 | 4.19 | 2.11 | 27.13 |
| **Nonvolatile Beta** | 6.48 | 2.9 | 2.5 | 1.9 | 2.69 | 2.12 | 8.06 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table G2. Radionuclides Greater Than or Equal to 1.0 Percent or Greater of Total Dose From Liquid Releases (Committed Dose)**

| Radionuclides | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Cs-137 | 51.0 | 47.3 | 46.8 | 43.2 | 35.8 | 47.2 | 59.11 |
| H-3 (oxide) | 40.5 | 41.7 | 43.2 | 40.5 | 39.8 | 36.3 | 25.08 |
| I-129 | | 1.7 | | 2.1 | 2.2 | 1.6 | 1.89 |
| Pu-239 | 2.2 | 4.0 | 4.3 | 8.8 | 17.2 | 9.4 | |
| Sr-89, 90 | | 5.3 | | | | | 1.91 |
| Sr-90 | 5.5 | | 5.4 | 4.2 | 3.6 | 3.8 | |
| U-234 | | | | | | | 1.72 |
| Alpha | | | | | | | 9.00 |
| Nonvolatile Beta | | | | | | | |
| **Radionuclides** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| Cs-137 | 42.89 | 35.84 | 39.1 | 53 | 42 | 57 | 56 |
| H-3 (oxide) | 41.41 | 38.14 | 40.02 | 31 | 36 | 32 | 17 |
| I-129 | 3.29 | 4.19 | 3.93 | 2 | 5 | | |
| Sr-89, 90 | 1.36 | | | | | | |
| Sr-90 | | | 1.03 | 1 | 3 | 1 | |
| U-234 | | | | | | | |
| Alpha | 9.89 | 18.43 | 1.13 | 2 | 11 | 8 | 24 |
| Nonvolatile Beta | 1.11 | 2.69 | 14.75 | 10 | 2 | | 1 |

1. Empty cells indicate no data reported.

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## Critical Pathway

**Table H1. Percent of Total Dose to the MEI for Atmospheric and Liquid Releases**

**MEI from Atmospheric Releases (MAXIGASP-SR Code) Percent of Total Dose**

| DOE-SR | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plume | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.4 | 0.5 | 0.2 | 0.4 | 0.0 | 0.0 | 0.0 |
| Ground | 0.2 | 0.2 | 3.6 | 1.6 | 1.8 | 1.1 | 1.0 | 1.7 | 0.7 | 2.1 | 1.7 | 1.6 | 2.3 | 6.4 |
| Inhalation | | 47.7 | 44.1 | 38.5 | 41.9 | 42.6 | 48.3 | 45.7 | 42.6 | 41.0 | 33.5 | 43.4 | 42.7 | 41.6 |
| Vegetation | 26.5 | 35.2 | 36.7 | 40.0 | 37.8 | 41.8 | 44.4 | 41.9 | 44.1 | 44.5 | 51.9 | 39.4 | 40.7 | 46.3 |
| Cow Milk | 8.3 | 12.0 | 11.2 | 11.6 | 10.7 | 10.4 | 4.6 | 7.3 | 9.0 | 9.1 | 9.6 | 11.3 | 10.3 | 1.5 |
| Meat | 3.5 | 5.0 | 4.5 | 8.2 | 7.8 | 4.0 | 1.7 | 2.9 | 3.2 | 3.2 | 2.9 | 4.4 | 4.0 | 4.3 |

**Cow Milk Pathway**

| 1993-2006 | Avg | SD | Median |
|---|---|---|---|
| Plume | 0.1 | 0.2 | 0.0 |
| Ground | 1.9 | 1.6 | 1.7 |
| Inhalation | 42.6 | 3.8 | 42.6 |
| Vegetation | 40.8 | 5.9 | 41.3 |
| Cow Milk | 9.1 | 2.9 | 9.9 |
| Meat | 4.3 | 1.8 | 4.0 |

**MEI from Liquid Releases Percent of Total Dose**

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish | 54.1 | 50.7 | 49.9 | 46.7 | 39.9 | 50.3 | 61.0 | 45.8 | 40.2 | 42.5 | 55.4 | 47.0 | 59.0 | 59.0 |
| Water | 45.7 | 49.2 | 50.0 | 53.2 | 60.0 | 49.6 | 38.5 | 53.9 | 59.5 | 57.2 | 44.2 | 53.0 | 41.0 | 41.0 |
| Shoreline | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.4 | 0.3 | 0.3 | 0.3 | 0.4 | <1 | <1 | <1 |
| Swimming | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | <1 | <1 | <1 |
| Boating | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | <1 | <1 | <1 |

**Potential MEI Dose from the Liquid Releases**

| 1993-2006 | Avg | SD | Median |
|---|---|---|---|
| Fish | 50.1 | 6.9 | 50.1 |
| Water | 49.7 | 6.9 | 49.8 |
| Shoreline | 0.2 | 0.1 | 0.2 |
| Swimming | 0.0 | 0.0 | 0.0 |
| Boating | 0.0 | 0.0 | 0.0 |

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## Critical Pathway

**Table I1. Committed Dose (mrem) for MEI and Sportsman Pathways (DOE-SR)**

| Path / Year | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Pathway | | 0.23 | 0.2 | 0.19 | 0.18 | 0.19 | 0.28 | 0.18 | 0.18 | 0.18 | 0.19 | 0.15 | 0.13 | 0.2 |
| Onsite Hunter | 57.3 | 46 | 30 | 21 | 26 | 56 | 77 | 63 | 14 | 39.5 | 15.6 | 70.8 | 8.8 | 22 |
| Offsite Hunter | 4.1 | 20 | 15 | 14 | 14 | 12 | 9.1 | 10.1 | 0.53 | 12.2 | 1.2 | 17.3 | 8.3 | 9.6 |
| Offsite Fisherman | 1.3 | 1.3 | 1.2 | 1.7 | 0.65 | 1.6 | 0.61 | 1.18 | 1.74 | 0.62 | 0.66 | 0.71 | 0.52 | 0.52 |

1. Empty cells indicate no data reported.
2. Data from tables in all WSRC referenced reports.

| | Statistics | | |
|---|---|---|---|
| 1993-2006 | Avg | SD | Median |
| All Pathway | 0.19 | 0.04 | 0.19 |
| ONS Hunter | 39.1 | 22.6 | 34.75 |
| OFS Hunter | 10.5 | 5.69 | 11.05 |
| OFS Fisherman | 1.02 | 0.46 | 0.945 |

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### 5.1.4 Summary Statistics
### Critical Pathway

Table 1. 2006 SCDHEC Dose (mrem[1]) Estimates for Exposure Routes, Pathways, and Media

| Exposure Routes | Pathways | | Media | MEI Dose (mrem) | +NORM[2] |
|---|---|---|---|---|---|
| **MEI Inhalation** | Air | | Air | **0.01** | |
| **0.22% of Dose** | Resuspended Soil[4] | | | **0.00** | **0.82** |
| | Resuspended Sediment | | | **0.00** | |
| | **Total Dose - Air Inhalation (12.28% of Dose)** | | | **0.01** | |
| **MEI Ingestion** | Food | | Fish | **0.44** | |
| **43.65% of Dose** | | | Deer avg (0.00-mrem) | **1.15** | |
| | | | Hog | | |
| | | | Vegetable | **0.01** | |
| | | | Milk | **0.20** | |
| | Soil | | Soil | **0.01** | **0.04** |
| | Sediment | | Sediment | **0.00** | |
| | **Total Dose - Food Ingestion (27.37% of Dose)** | | | **1.81** | |
| | Water | Potable | PWS River Water | 0.07 | |
| | | | PWS Wells | 0.04 | |
| | | | DNR Wells[5] | **0.15** | **1.10** |
| | | Nonpotable | Swamp/SW[3] | 0.06 | |
| | | | Rainwater | 0.01 | |
| **MEI** | **Total Dose-DW Ingestion (18.49% of Dose)** | | | 0.33 | |
| **Direct Exposure** | Air | Cloud | Submersion | | |
| **56.12% of Dose** | | Skin | Absorption | | |
| | Water | Swimming | Immersion | 0.00 | |
| | | Skin | Absorption | 0.00 | |
| | Soil | Ground | Shine[6] | 0.00 | **0.31** |
| | | TLD | Absorption | **2.52** | |
| | Sediment | Shoreline | Shine | 0.00 | |
| | **All Direct Total Exposure (41.86% of Dose)** | | | **2.52** | |
| **Total Offsite Dose - All Pathways** | | | | **4.49** | **2.27** |
| | | | | MEI plus NORM Dose | **6.76** |

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## Summary Statistics
## Critical Pathway

Table 2. Average Dose (millirem) Rank by Radionuclide

| 1999-2006 | Sum | Avg | SD | Median | %of Total | 2006 | Sum | Avg | SD | Median | %of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cs-137** | 13.52 | 0.56 | 0.99 | 0.24 | 42.39 | b-gamma | 2.52 | 2.52 | | 2.52 | 41.18 |
| b-gamma | 6.69 | 0.84 | 1.16 | 0.00 | 20.97 | alpha | 1.07 | 0.27 | 0.38 | 0.12 | 17.52 |
| alpha | 5.57 | 0.37 | 0.74 | 0.04 | 17.45 | Ra-226 | 1.01 | 0.51 | 0.64 | 0.51 | 16.50 |
| Ra-226 | 3.54 | 0.59 | 0.63 | 0.51 | 11.10 | **Cs-137** | 0.79 | 0.26 | 0.45 | 0.00 | 12.86 |
| **H-3** | 0.58 | 0.01 | 0.01 | 0.01 | 1.82 | **Sr-89/90** | 0.20 | 0.10 | 0.14 | 0.10 | 3.20 |
| **Sr-89/90** | 0.44 | 0.11 | 0.12 | 0.10 | 1.37 | Ra-228 | 0.11 | 0.11 | | 0.11 | 1.72 |
| Ac-228 | 0.35 | 0.12 | 0.02 | 0.11 | 1.09 | Ac-228 | 0.10 | 0.10 | | 0.10 | 1.58 |
| Pb-214 | 0.22 | 0.07 | 0.03 | 0.08 | 0.68 | Pb-214 | 0.08 | 0.08 | | 0.08 | 1.23 |
| **Sr-89** | 0.19 | 0.06 | 0.09 | 0.01 | 0.58 | **Zn-65** | 0.07 | 0.07 | | 0.07 | 1.19 |
| Ra-228 | 0.19 | 0.09 | 0.02 | 0.09 | 0.58 | **H-3** | 0.07 | 0.01 | 0.01 | 0.00 | 1.13 |
| **U-234** | 0.15 | 0.15 | | 0.15 | 0.46 | Pb-212 | 0.06 | 0.06 | | 0.06 | 0.90 |
| **Eu-155** | 0.12 | 0.06 | 0.07 | 0.06 | 0.37 | **U-238** | 0.04 | 0.04 | | 0.04 | 0.60 |
| beta | 0.09 | 0.01 | 0.01 | 0.01 | 0.28 | beta | 0.03 | 0.01 | 0.01 | 0.00 | 0.44 |
| Pb-212 | 0.09 | 0.05 | 0.01 | 0.05 | 0.28 | **Sr-89** | 0.00 | | | | 0.00 |
| **Zn-65** | 0.07 | 0.07 | | 0.07 | 0.23 | **Sr-90** | 0.00 | | | | 0.00 |
| **U-238** | 0.06 | 0.01 | 0.01 | 0.01 | 0.19 | **U-234** | 0.00 | | | | 0.00 |
| **U-235** | 0.03 | 0.01 | 0.00 | 0.01 | 0.08 | **U-235** | 0.00 | | | | 0.00 |
| **Sr-90** | 0.01 | 0.01 | 0.00 | 0.01 | 0.04 | **Pu-239/24** | 0.00 | | | | 0.00 |
| **Ce-144** | 0.00 | 0.00 | | 0.00 | 0.01 | **Am-243** | 0.00 | | | | 0.00 |
| **Am-243** | 0.00 | 0.00 | | 0.00 | 0.01 | **Pu-238** | 0.00 | | | | 0.00 |
| **Pu-239/240** | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | **Pu-239** | 0.00 | | | | 0.00 |
| **Pu-238** | 0.00 | 0.00 | | 0.00 | 0.00 | **Ce-144** | 0.00 | | | | 0.00 |
| **Tc-99** | 0.00 | 0.00 | | 0.00 | 0.00 | **Tc-99** | 0.00 | | | | 0.00 |
| **Pu-239** | 0.00 | | | | 0.00 | **Eu-155** | 0.00 | | | | 0.00 |
| **Totals** | 31.90 | | | | 100.01 | | 6.12 | | | | 100.05 |

Notes:
1. This table uses average deer and hog dose and not MEI deer and hog dose.
2. Previous data submission errors are corrected in this table.
3. Most alpha and beta detections resulted from the assignment of unknown alpha as Pu-239 and unknown beta as Sr-90.
4. Detections of 0.00 were less than 0.005 mrem, and grey areas are not applicable.
5. Bold type indicates potentially nonNORM radionuclides based on media locations and other factors.
6. Nonbold type indicates potentially NORM radionuclides based on media locations and other factors.
7. TLD b-gamma are based on 1 mR (milliroentgen) = 1 mrem (millirem).

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## Summary Statistics
## Critical Pathway

Table 3. 1999-2006 SCDHEC Detected Dose in Millirem Within 50 Miles of the SRS (Excluding NORM)

| Media | Year | | | | | | | | 8 Yr. | % ALL[1] Media | | 1999-2006 Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Totals | Avg | MEI | Avg. | SD | Median |
| Surface Water[2] | 0.04 | 0.09 | 0.03 | 0.05 | 0.07 | 0.04 | 0.06 | 0.06 | 0.45 | 2.23 | 0.45 | 0.06 | 0.02 | 0.06 |
| DNRGW[3] | | | | | 0.02 | 0.05 | 0.01 | 0.15 | 0.22 | 1.10 | 0.22 | 0.06 | 0.07 | 0.03 |
| PWSGW[4] | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.05 | 0.04 | 0.04 | 0.17 | 0.83 | 0.17 | 0.02 | 0.02 | 0.02 |
| PWSRW[5] | 0.03 | 0.03 | 0.01 | 0.02 | 0.03 | 0.01 | 0.06 | 0.07 | 0.26 | 1.29 | 0.26 | 0.03 | 0.02 | 0.03 |
| Rainwater | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | 0.09 | 0.42 | 0.09 | 0.01 | 0.01 | 0.01 |
| Soil | 0.00 | 0.01 | 0.01 | 0.00 | 0.02 | 0.02 | 0.02 | 0.01 | 0.09 | 0.45 | 0.09 | 0.01 | 0.01 | 0.01 |
| Sediment | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| TLD[6] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.97 | 2.20 | 2.52 | 6.69 | 33.38 | 6.77 | 0.84 | 1.16 | 0.00 |
| Air | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.06 | 0.31 | 0.06 | 0.01 | 0.01 | 0.01 |
| Vegetables | | | | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.03 | 0.16 | 0.03 | 0.01 | 0.00 | 0.01 |
| Milk | 0.04 | 0.05 | 0.00 | 0.00 | 0.09 | 0.18 | 0.00 | 0.20 | 0.56 | 2.80 | 0.57 | 0.07 | 0.08 | 0.05 |
| Fish | 1.08 | 0.32 | 0.27 | 0.61 | 0.30 | 0.44 | 0.62 | 0.44 | 4.08 | 20.37 | 4.13 | 0.51 | 0.27 | 0.44 |
| Avg Deer[7] | | 0.27 | 0.08 | 1.35 | 0.21 | 0.84 | 0.00 | 0.00 | 2.75 | 13.72 | | 0.39 | 0.51 | 0.21 |
| Avg Hog[7] | | 0.97 | 0.00 | 3.62 | | | | | 4.59 | 22.90 | | 1.53 | 1.87 | 0.97 |
| | Total for media averages > background[10] | | | | | | | | 20.04 | | | Avg. | SD | Median |
| MEI Deer[8] | | 6.18 | 8.36 | 20.25 | 5.58 | 15.74 | 7.64 | 1.15 | 64.90 | | 65.66 | 9.27 | 6.52 | 7.64 |
| MEI Hog[8] | | 4.29 | 0.00 | 16.95 | | | | | 21.24 | | 21.49 | 7.08 | 8.81 | 4.29 |
| Food Media[9] | Total for all MEI averages>background[10] | | | | | | | | 98.84 | | | Avg. | SD | Median |
| MEI Sportsman Avg | 1.08 | 3.60 | 2.88 | 12.60 | 2.94 | 8.09 | 4.13 | 0.80 | 36.11 | | | 4.51 | 3.96 | 3.27 |
| MEI Sportsman Total | 1.08 | 10.79 | 8.63 | 37.81 | 5.88 | 16.18 | 8.26 | 1.59 | 90.22 | | | 11.28 | 11.78 | 8.45 |
| Nonsportsman Food Avg | 0.04 | 0.05 | 0.00 | 0.00 | 0.05 | 0.10 | 0.00 | 0.11 | 0.34 | | | 0.04 | 0.04 | 0.05 |
| Nonsportsman Food Total | 0.04 | 0.05 | 0.00 | 0.00 | 0.10 | 0.19 | 0.00 | 0.21 | 0.59 | | | 0.07 | 0.08 | 0.05 |
| MEI Scenarios[11] | | | | | | | | | Totals | | Years | Avg. | SD | Median |
| MEI Sportsman[11a] | 1.18 | 10.95 | 8.68 | 37.86 | 6.08 | 18.41 | 10.55 | 4.49 | 98.21 | | 1999-06 | 12.28 | 11.54 | 9.62 |
| General Public[11b] | 0.09 | 0.09 | 0.02 | 0.02 | 0.14 | 0.24 | 0.07 | 0.37 | 1.04 | | 1999-06 | 0.13 | 0.12 | 0.09 |
| Farmer[11c] | 0.06 | 0.07 | 0.03 | 0.00 | 0.15 | 2.23 | 2.27 | 2.90 | 7.72 | | 1999-06 | 0.96 | 1.26 | 0.11 |
| Average Sportsman[11d] | 1.18 | 1.72 | 0.40 | 5.63 | 0.66 | 3.51 | 2.91 | 3.34 | 19.36 | | 1999-06 | 2.42 | 1.76 | 2.32 |
| Additional NORM[12] | 0.00 | 0.00 | 0.00 | 0.00 | 1.20 | 2.62 | 3.60 | 2.27 | 9.69 | | 1999-06 | 1.21 | 1.45 | 0.60 |
| NORM plus MEI[13] | 1.18 | 10.95 | 8.68 | 37.86 | 7.28 | 21.03 | 14.15 | 6.76 | 107.91 | | 1999-06 | 13.49 | 12.99 | 10.22 |

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## Summary Statistics
## Critical Pathway

Notes: The 2006 graphs and tables represent a re-evaluation of past years TLD, soil, game animal, and rainwate
1. % (Percent) of all media means all drinking water dose sources are included in the total dose and media categ
are divided by either the media average or an average including the MEI sportsman dose. This biases the total d
the highside due to multiple source consumptions at the same maximum consumption rate.
Rainwater data were re-analyzed and included as a possible drinking water ingestion source from cisterns.
2. Surface water sportsman expousre at the Savannah River boat landings is due to boiling river water for cooki
3. DNRGW is the Department of Natural Resources groundwater wells as possible exposure for private wells.
The NORM data (1999 through 2002) will be re-evaluated in the 2007 report to represent all dose including NOR
Past reports were concerned only with possible dose from SRS.
4. PWSGW refers to the dose from public water systems using groundwater.
5. PWSRW refers to the dose from public water systems using Savannah River Water downstream of SRS.
6. TLD refers to thermoluminescent dosimeter detections of beta-gamma.
Change - The subtraction of an outer ring of TLD data (only locations with no missing or stolen TLDs)
from an inner ring of TLD data locations along the SRS perimeter gives a more realistic assessment of the dose
difference than the use of a single background location, which may have been biased by nearby buildings materia
7. Avg Deer and Hog dose is based on the subtraction of avg background dose from the avg perimeter dose.
8. MEI Deer or Hog refers to the maximum possible dose consumed by a single hunter.
Older reports of deer and hog data combined as game animal were analyzed separately
to represent the worst-case MEI Sportsman who consumed all of the worst-case deer and hog dose.
9. Food Media compares the general public average and total dose from vegetable and milk consumption
to the sportsman consumption of fish and game animals sampled (deer/hog).
10. The % of ALL Media "Avg" column is contrasted with the % of ALL Media "MEI" column, which are base
on dividing by different totals that used average game animal (deer and hog) versus MEI game animal dose.
11. MEI Scenarios use the maximum possible dose (bold numbers) from one drinking water source along with
the other media that apply to that scenario.
11a. The MEI Sportsman scenario includes the highest drinking water dose (bold numbers), plus the
soil media rows through the fish media rows, plus the MEI game animal (MEI hog plus deer) dose.
11b. The General Public scenario includes only the nonsportsman dose encountered by the general public, i.e., tl
air, vegetable, milk, and highest drinking water dose (except the nonpotable surface water dose at boat landings).
11c. The Farmer scenario adds the soil, sediment, and the highest groundwater dose to the General Public Scena
11d. The Average Sportsman scenario replaces the MEI game animal (worst-case possible dose) with the average
above background for all deer sampled.
12. Additional NORM refers to detected dose that was probable NORM.
13. The NORM plus MEI dose detections or the total detected dose above background regardless of source.
The summary statistics for the 2006 and 1999-2006 data are in the right side columns for the referenced rows.
14. The 1999-2002 data were re-evaluated using the dose factors used since 2003, and known errata were correct
This resulted in small changes to some media dose(rounding), rainwater, and the correction of some media errors
15. The assignment of the NORM designation is explained under the applicable media result description.
Some general observations are given below.
15a. NORM that occurs in upgradient wells coupled with distance from recharge areas, and the lack of air sampl
detections of resuspended soil potential dose supported the exclusion of certain detections as probable NORM.
15b. The Avg Sportsman represents a more realistic potential dose than the MEI Sportsman dose based on extre
15c. The median may be a better indicator of the central tendency in environmental dose for all scenarios
due to the reasons stated in this report, and the average represents a more conservative estimate.
16. Previously reported lab error for air inhalation applied only to alpha determination hold times and not to spe
radionuclide determinations.

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## 6.1 2004 Dose Calculation

### 6.1.1 Summary

The Environmental Surveillance and Oversight Program of the South Carolina Department of Health and Environmental Control (SCDHEC) monitors the Savannah River Site (SRS) and perimeter areas under an Agreement in Principle with the Department of Energy (DOE). The Department of Energy – Savannah River (DOE-SR) and SCDHEC used data from their respective monitoring activities to calculate the potential radiation dose to the surrounding public. SCDHEC implemented a Radiological Dose Calculation Project in 2002 to calculate the potential exposure or dose to the public around the SRS, and to evaluate DOE-SR dose results published in the SRS Environmental Reports.

The SCDHEC dose calculations are an independent estimate of radiological dose to the public near the perimeter of the SRS. This project used dose instead of risk so that direct comparisons of dose magnitude could be made with data published in the SRS Environmental Reports.

**RESULTS AND DISCUSSION**

Radiation exposures to the Maximally Exposed Individual (MEI) from each exposure media were categorized into primary exposure routes and pathways (atmospheric, liquid pathways) that are subdivided into other more specialized exposure pathways or media. The dose from the radionuclides were organized to represent an additive dose estimate (Table 1, section 6.1.2) for 2006 occurring in specialized pathways (Section 6.1.3), which represented types of media exposure and lifestyle (e. g., potable and nonpotable drinking water media, farmer, general public and the sportsman hunter). Note that all drinking water doses are not added together, since a source or a maximum exposure for a particular scenario had to be assumed. A brief comparison was made to dose values published by the DOE-SR. This comparison assisted the SCDHEC in evaluating the 2006 DOE-SR environmental monitoring program and the SCDHEC ESOP environmental monitoring program.

Table 1, section 6.1.2 divides the SCDHEC detected dose into two columns, MEI Dose and Naturally Occurring Radioactive Material (NORM). The NORM dose is a judgment call based on media location knowledge, radioactive material knowledge, and a lack of supporting evidence in related media that would indicate a nonNORM determination. For example, a soil or swamp sediment resuspension inhalation dose can be calculated, but is not realized unless air filters capture some of that potential dose. Dose found in groundwater upgradient of the SRS is assigned as probable NORM even if these particular radionuclides were stored, produced, or released as by-products at the SRS. This determination is based on minimal groundwater flow rates from the aquifer recharge areas. Thus, the location of the detected radionuclides, the distance from upstream recharge areas, and the known presence of the material in aquifers originating in saprolitic granite, dictated a NORM assignment for that dose. Only the doses in bold numbers (e.g., maximum drinking water dose found at DNR wells) were added to represent totals for the MEI and NORM dose detections. Other drinking water doses were used in subsequent dose criteria scenarios to better define the dose in different categories of environmental exposure. Table 1, section 6.1.2 “percent of dose” for a particular exposure route

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or pathway was determined based on a nonNORM MEI basis (divided by 4.49 mrem) and an overall MEI plus NORM basis (divided by 6.76 mrem). Tables 1-16, section 6.1.3 include data corrections for error detection submissions.

**The Atmospheric Pathway**

ESOP Air Inhalation Dose Results

Because radiological activity was difficult to detect at the SRS boundary, DOE-SR used a MAXDOSE-SR computer-modeling program to estimate the dose values to their MEI (WSRC 2002a, b). Data used in the DOE-SR monitoring program were from stack emissions as well as diffuse and fugitive emissions around the SRS (WSRC 1998c, 1999a, 2000a & b, 2001a & b, 2002 a & b, 2003, 2004, 2005, 2006, and 2007). Figure 1, section 6.1.2 shows the comparable dose values above background in mrem excluding probable NORM, calculated by SCDHEC (Table 3, section 6.1.4) for different media and pathways from 1999 through 2006 (SCDHEC 2006e). The 0.005 mrem SCDHEC MEI air dose in 2006 was typical of detections in past years of less than 0.01 mrems, and well below the DOE-SR 2006 air dose estimate for potential atmospheric releases of 0.11 mrems to the MEI (WSRC 2007). The air pathway difference of SCDHEC was due primarily to the DOE-SR air dose release estimates for diffuse and fugitive sources that did not result in aerial deposition detections within the SRS 50-mile perimeter of greater than 0.01 mrem.

The inhalation pathway dose attributed to resuspended soil and sediment was more significant (0.82 mrem), and was predominantly influenced by unknown alpha (0.816 mrem) being assigned as a Pu-239 dose, which is biased on the very conservative side for dose estimation. This potential resuspended soil alpha from a six-inch average depth was not backed up by air filter detections close to SRS, and is most likely due to NORM alpha (Table 1, section 6.1.2). The actual air filter average detection of 0.01 mrem (after rounding off) is only 1.22 % of the potential resuspended alpha possible detection (0.82 mrem), which in total (filter results plus potential soil resuspension that includes probable NORM or 0.83 mrem) is 8.30 % of the DOE 10 mrem allowed air standard. The potential inhalation dose (MEI 0.01 mrem plus NORM contribution 0.82 mrem) was 12.28 % of the overall dose (6.76 mrem) detected by SCDHEC samples. However, the MEI inhalation dose (0.01 mrem) excluding probable NORM was only 0.22 % of the total SCDHEC MEI detected dose (4.49 mrem). Thus, the potential air inhalation dose resident in NORM soils (0.82 mrem) was much greater than the MEI exposure from man-made radionuclides (0.01 mrem). This is part of the 300-mrem United States annual average NORM dose. Thus, the 1999 to 2006 MEI air inhalation detected dose average for the SRS 50-Mile Perimeter was 0.01 mrem. Only 9.09 % of the DOE-SR estimated atmospheric releases (WSRC 2006) of 0.11 mrem were detected by SCDHEC air sampling. Thus, either most of the DOE-SR potential diffuse and fugitive release estimates did not occur, were deposited within SRS, or were deposited by weather factors at distances beyond SCDHEC sampling locations.

The NORM dose estimates from coastal plains soils (0.82 mrem) were included in the DOE-SR perimeter overall dose only because they were greater than a random background average that included piedmont soils (unknown alpha and beta, and radium “Ra”-226). Some of the probable NORM occurring in the soil and sediment samples may be of DOE-SR origin, since these potential radioactive decay series release by-products were processed or stored at the SRS and

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played a major role in the diffuse and fugitive releases potential dose estimate. However, the air filters did not pick up this large potential dose and was, therefore, probable NORM detections in soil. Most of the soil NORM alpha dose could be due to erosion of saprolitic formations (rather than an aerial deposition) from upstream areas that are known to contain higher levels of naturally occurring uranium, radium, and other decay products (SCDHEC 2006e). DOE-SR potential soil exposure was calculated by WSRC as 3.18 mrem total for the hunter and fisherman exposed to Savannah River swamp soil (WSRC 2007). The SCDHEC total NORM detection from soil and sediment was 1.17 mrem (0.82+0.04+0.31) (Section 6.1.2, Table 1) or 17.31 % of the 2006 total MEI plus NORM detected dose of 6.76 mrem. An additional 2.53 mrem (2.52+0.01) was attributed as MEI dose excluding NORM or 56.35 % of the 2006 MEI only detected dose. The SCDHEC total soil dose excluding probable NORM (2.53 mrem) was less than the DOE-SR estimate (3.18 mrem). The inclusion of SCDHEC probable NORM detections (1.17 mrem) raised the potential soil dose to 3.70 mrem or 54.73 % of the total MEI plus NORM dose detections (6.76 mrem).

The SCDHEC air samplers should have detected any deposited dose whether resuspension or direct deposition. Since SCDHEC air samples did not detect the additional dose calculated for resuspended soil, the resuspension of the potential dose from detected NORM in soils was not confirmed. Also, wet swamp soil cannot be resuspended in the atmosphere and contribute to the airborne pathway unless drying occurs first.

Thermoluminescent Dosimeter (TLD) Dose Results

The TLD are replaced quarterly (since 2001) and deployed one meter above the soil in various locations to measure ambient beta-gamma continually. The TLD exposures above background levels are considered as originating from artificial sources. Only locations with no missing data (some TLD disappeared) were used in these updated calculations to eliminate any low bias in averaging. The direct exposure from all SRS perimeter TLD, minus the outer perimeter background TLD (rather than a single farthest location), averaged 1.97 mrem in 2004 for unknown beta/gamma activity, 2.20 mrem in 2005, and 2.52 mrem in 2006. Use of the average outer perimeter locations as background instead of a single location allowed for the effects of differing soil types and the resident NORM on TLD exposure. Background cosmic radiation accumulated by the TLD during airline transport to and from the vendor for analysis was subtracted from the TLD yearly averages to obtain the gamma dose at the SRS perimeter locations (SCDHEC 2006e). SCDHEC plans to establish a TLD background location near Beaufort, South Carolina in 2007. The average TLD detected dose difference between inner and outer perimeter locations was 0.84-mrem (±1.16) for 1999-2006 (Table 3, section 6.1.4).

Both DOE-SR and SCDHEC perimeter population location results were influenced by building and road material NORM. The similarly located TLD perimeter averages of the two programs are not directly comparable due to differences in collection times, and differing distances from a building or road NORM source. The higher TLD values, in general, were similar to the Aiken SCDHEC building control due to the close proximity to buildings or road materials.

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SCDHEC Edible Vegetation Dose Results

The SCDHEC MEI total dose above background for edible vegetation (leaves and fruit) came from only one radionuclide (tritium at 0.007 mrem total). The DOE-SR MAXDOSE-SR estimate from the cow milk pathway for vegetation dose was 0.05 mrem. The main differences in the DOE-SR and SCDHEC tritium dose are due to differences in locations, crops sampled, and consumption factors. The MEI dose from vegetable consumption was less than that typically received from watching TV for one year (1 mrem/yr) (SCDHEC 2006f). The edible vegetation dose average within the SRS 50-Mile Perimeter for the SCDHEC 2002-2006 period was 0.01 mrem (± 0.00) (Table 3, section 6.1.4). Thus, the uptake of these radionuclides was less than estimated releases by the WSRC 2007 calculations for the cow milk pathway (0.05 mrem), and this may be due to weather related depositional patterns.

ESOP Soil Exposure Dose Results

Six gamma-producing radioisotopes produced detectable concentrations in surface soil samples. Surface soil dose was considered to come from ingestion, direct radiation exposure, and inhalation of resuspended soil (including dried sediments) due to farming and wind erosion of dry soil. NORM detection levels greater than background may reflect soil type differences. The probable total soil NORM detections were 1.17 mrem or 17.31% (Table 1, section 6.1.2) of the total dose (6.76 mrem) detected in the 2006 SCDHEC samples. The MEI soil dose excluding NORM was 2.53 mrem (56.35% of the MEI nonNORM dose) versus 3.70 mrem including NORM (54.73% of the total MEI plus NORM dose). Most of this dose was due to assigning unspecified resuspended alpha as Pu-239 (0.82 mrem), and unspecified beta-gamma from TLD detections (2.52 mrem) greater than the SC background. NORM detection levels greater than background that were also by-products or stored by DOE-SR were considered as originating from an SRS aerial deposition or upstream flood source (SRS streams). All dose in 2006 soils came from unknown alpha assigned as Pu-239, beta-gamma, actinium-228, zinc-65, radium-226, lead-212 and lead–214, unknown beta assigned as strontium-90, and cesium-137 (Table 16, section 6.1.3). Unknown alpha and beta can be any alpha and beta decay radionuclide, and therefore the nonNORM soil dose was potentially far less than the calculations based on Pu-239 and Sr-90. NORM was included in the overall DOE-SR perimeter dose because this dose was greater than the South Carolina background average that included piedmont soils. Local NORM greater than the South Carolina background probably reflects local variations in the levels of radionuclides that contribute to the national NORM average. However, local NORM may be included as additional potential dose if SRS has stored and/or produced these radionuclides in the past as indicated by release estimates for these products in the SRS environmental reports.

The possible ingestion of contaminated sediment and soil along the banks of SRS streams and inhalation of resuspended soil (dried sediment and soil on stream banks and in fields) in windy conditions may contribute to the MEI dose (Table 16, section 6.1.3). Wet soil and clothing greatly reduce beta penetration to the skin and direct exposure to gamma (shine) from surface soil. The 1999-2006 soil average dose excluding NORM was 0.01 mrem (± 0.01) within the SRS 50-Mile Perimeter, and sediment was 0.00 mrem at two significant digits (Table 3, section 6.1.4). The addition of probable NORM detections in soil increased the potential dose to the MEI by a factor of 1.46, i.e. ((2.53+1.17)/2.53). The potential NORM dose was added to the

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MEI only because it represented dose above the South Carolina background with an uncertain origin, even if not resuspended. The DOE-SR soil exposure results indicated potential exposure to the hunter and fisherman (3.18 mrem total) from a combination of external exposure, incidental ingestion, and inhalation of Savannah River soil (WSRC 2007). This exposure pathway is covered primarily under the Sportsman Pathway of this report.

The radionuclides in sediments represent a potential dose based on the sediments becoming exposed if the Savannah River dried up to the point of exposing sediments. Beta, Cs-137, and Tc-99 were detected above background at Steel Creek Landing. Only nonvolatile beta assigned as Sr-90 in dry sediment would result in a dose at two significant places. Over half of this dose is based on sediment inhalation as dried resuspended soil and is not backed up by air station detections for beta at the indicated levels, and wet soil and ground roughness at riverbanks would greatly reduce beta exposure. Thus, this hypothetical sediment dose is not assigned to the MEI in 2006. ESOP plans to use dry riverbank soil in place of sediments to improve the dose analysis for the boat landing locations in 2007.

Milk Dose Results

The SCDHEC MEI total dose above background for cow milk in 2006 (Table 16, section 6.1.3) was 0.20 mrem/yr. That dose was 98.49 % strontium-89/90 (Sr-89, 90), and 1.51% tritium. Only vegetables (0.01 mrem) contained a lower dose than milk (0.20 mrem) among the food groups sampled in recent years (Section 6.1.2, Figure 2).

Milk is well below the MEI deer (1.15 mrem) and fish (0.44 mrem) 2006-year average radionuclide detection levels. The SCDHEC overall average cow milk dose since 1999 was 0.07 mrem (±0.08) with a range of 0 to 0.20 mrem (Table 3, section 6.1.4). This milk dose was far less than that received by watching TV for one year (1 mrem) (SCDHEC 2006f). The DOE-SR cow milk total dose was 0.11 mrem in 2006, and has an overall dose range of 0.01 to 0.11mrem since 1999. DOE-SR data include detections less than the MDA level normally detected by SCDHEC (WSRC 2007), which lowers the overall average in comparison to SCDHEC detections that were greater than an MDA. DOE-SR milk dose (0.11 mrem) was within one standard deviation of the SCDHEC 1999-2006 dose average (0.07 mrem ± 0.08). The dominant dose in past milk samples came from Cs-137 in goat milk and Sr-89 in the 2004-year cow milk solids.

**The Liquid Pathway**

ESOP Drinking Water Dose Results

Five drinking water dose values were calculated by SCDHEC for the 2006 liquid exposure pathway (Table 15, section 6.1.3 and Table 3, section 6.1.4). The average of all five drinking water sources was 0.07 mrem (± 0.05). First, a 2006 drinking water dose maximum (0.07 mrem) was calculated for drinking water customers of Beaufort/ Jasper and Port Wentworth public utilities based only on detections above an MDA. The river water studies represented a maximum overall average dose to the downstream public of 0.07 mrems from the liquid pathway

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or 1.75 % of the EPA 4-mrem drinking water standard. Second, a drinking water dose (<0.06 mrem) was calculated for a member of the public who drank surface water from the Steel Creek, Little Hell, and Burton's Ferry (Hwy 301) boat landings. Third and fourth, the Public Water Systems groundwater wells (0.04 mrem) and the South Carolina Department of Natural Resources (SCDNR) groundwater monitoring wells (0.15 mrem plus 1.10 mrem from NORM) represented the potential dose that may occur in PWS wells and/or private wells. The SCDNR groundwater dose was due mostly to probable NORM (upgradient of SRS) with Ra-226 (0.96 mrem) and Ra-228 (0.11 mrem) averages greater than the 2006 background. The remainder was total U assigned as U-238 (0.04 mrem). Fifth, rainwater contained the minimal dose of all water sources and indicated the potential dose to cistern water supplies at individual homes (0.01 mrem ± 0.01). The individual drinking water dose exposure should be no greater than a single source maximum and most of the drinking water dose (NORM) was found in groundwater downgradient of saprolitic granite, but upgradient of the SRS.

The SCDHEC MEI was assumed to use river and boat landing water sources for drinking, cooking, and well water. A survivalist type of individual might consume water from the Burton's Ferry, Little Hell, and Steel Creek boat landings surface water sources. Free flowing artesian water is present at the Burton's Ferry and Little Hell boat landings. Contamination at these Savannah River boat-landing locations was possibly reduced by the influx of fresh artesian water. The maximum SCDHEC MEI drinking water dose from river surface water at these boat landings was 0.06 mrem.

Radium-226 contributed the largest overall (ground water and river water) water dose from all sources (0.96 mrem) in year 2006, unspecified alpha second (0.25 mrem), Ra-228 third (0.11 mrem), tritium fourth (0.05 mrem), total uranium assigned as U-238 fifth (0.04 mrem), and unspecified beta sixth (0.02 mrem) (Table 15, section 6.1.3). The inclusion of unspecified alpha and beta dose (as Pu-239 and Sr-90 respectively) probably represent counting some of the same dose twice (speciation versus gross determinations in separate samples), and inflates the dose calculations by recounting the same source and inflating it as Pu-239 or Sr-90.

The upgradient DNR wells were assumed to represent the NORM dose possible from very deep private wells (1.10 mrem). The alpha contribution may be counted twice since unknown alpha (0.15 mrem) may comprise the radium (1.06 mrem) from other speciated samples. It was not unusual for private wells in some areas of Aiken County to be drilled to a depth of 300 or more feet. These wells were deep enough to accumulate dissolved NORM from upgradient sources of saprolitic granite that occur in the aquifer recharge areas (Colquhoun, et. al. 1983). The higher detections above background for total uranium, Ra-226, Ra-228, and gross alpha/beta occurred predominantly in wells north of SRS, at less than 150-foot depth, and terminated in the Steed's Pond aquifer. Typical tritium levels should be the leading indicator of contamination in groundwater, but all PWS and DNR well water detections in 2006 were less than the lower limit of detection (typically <190 pCi/L) (SCDHEC 2006g). Groundwater was not monitored off-SRS by the DOE-SR.

The SCDHEC Savannah River liquid pathway maximum dose detection was less than 0.09 mrem during the past eight years, but DOE-SR potential dose estimates were 0.09 to 0.22 mrems during that same period. SCDHEC composites tend to give lower sample results than grab

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samples due to the dilution effect of combining higher sample detections with lower sample detections. Another dilution effect was due to the increasing volume from tributary streams that occurred between the MEI drinking water location and the public water intakes that are farther downstream.

The SCDHEC surface water dose at boat landings averaged 0.06 mrem (± 0.02) within the SRS 50-Mile perimeter study area for the period 1999-2006. The Savannah River water dose to the downstream water suppliers averaged 0.03 mrem (± 0.02) for the same period. This was within one standard deviation of the DOE-SR drinking water average over the same period (0.05 mrem), and the DOE-SR 2006 average of 0.03 mrem. Differences are primarily attributable to sampler positioning and locations. Also, public water supply wells (0.04 mrem) were within one standard deviation of the Savannah River drinking water results for the eight-year period (0.02 mrem ± 0.02) excluding NORM (Table 3, section 6.1.4). DOE-SR does not monitor off-SRS PWS wells. However, note that the DNR wells show local potential NORM dose differences due to the various well locations sampled in a given year (Tables 6, 9, 12, 15, section 6.1.3).

Fisherman Dose Results

The total dose above background from all fish collected by SCDHEC in 2006 was 0.79 mrem, and the average dose from equal consumption of the four fish species surveyed was 0.26 mrem (Table 14, section 6.1.3). Bass contained the highest dose to the MEI for Cs-137 (0.44 mrem), catfish for Sr-89/90 (0.001 mrem), and carp contained the highest tritium (0.002 mrem). The MEI survivalist would probably take advantage of all edible fish. However, the highest total dose for bass (0.44 mrem) and per radionuclide gave the same result and represented the MEI fish consumption dose for SCDHEC. The DOE-SR maximum off-SRS fish dose (0.24 mrem) was lower than that observed by SCDHEC (0.44 mrem). The average fish dose from 1999 to 2006 (0.51 mrem) illustrates that fish was the second most important food contributor to the MEI dose during that period. Thus, the SCDHEC swamp fisherman total dose was 0.44 mrem in year 2006 compared to the WSRC estimate of 0.52 mrem (WSRC 2007, Table 6-4).

SCDHEC used sediment data in the past from SV-2018, SV-2019, and SV-118 that was greater than the background at SV-2010 to estimate accidental ingestion, inhalation, and direct exposure to resuspended dried sediment from stream banks. This hypothetical exposure based on wet sediment was not assigned to the MEI due to the lack of similar dose from resuspension in air filter detections. Sediment samples will be replaced by riverbank soil samples for sportsman dose estimates in 2007.

The importance of soil is heavily influenced by possible NORM included within the soil category. Table 3, Section 6.1.4 clearly indicates that when the fish dose is compared to average and MEI game animal (deer and hog) dose, then MEI deer and hog dose (Cs-137) move beta-gamma dose (TLD detections) to third, and fish moves from third (average dose) to fourth (MEI dose). The exclusion of resuspended NORM soil dose can be justified in that the air filters did not confirm the NORM dose, which was mostly due to calculating unknown alpha as Pu-239. This NORM dose was included as a possible added dose only because it was above the South Carolina background.

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Cesium-137 can bioaccumulate (3000:1 for water) in fish and was the dominant contaminant in the SCDHEC and DOE-SR (WSRC 2007) fish dose. Cesium-137 releases from leaking fuel elements to the liquid pathway occurred in the 1950s and 1960s, and due to its long half-life (30.2 yrs) continues to contaminate fish today. The liquid releases show up primarily in the aquatic biota (fish and crustaceans) and sediments. The fish dose (0.44 mrem) was 9.80 % of the total MEI dose (4.49 mrem), and was 13.17 % of the 2006 average sportsman dose (3.34 mrem). The difference is in the compared data, MEI deer dose versus average deer dose (Table 3, section 6.1.4). The 1999-2006 average fish dose was 0.51 mrem (±0.27) within the SRS 50-Mile Perimeter.

**All-Pathway Dose**

The DOE-SR All-Pathway dose excludes the sportsman dose and refers to the combined air and liquid doses from inhalation of air particulates and ingestion of water near the site boundary. These combined dose estimates are much less than the dose received from watching TV for one year (1 mrem) (SCDHEC 2006f).

A SCDHEC drinking water dose maximum (0.07 mrem) was calculated for the downstream drinking water customers of Beaufort/ Jasper and City of Savannah public utilities. This is less than the upgradient public water supply wells (0.145 mrem) dose from unknown alpha. DNR upgradient groundwater wells gave a higher total dose (1.245 mrem total) that includes NORM detected above background (1.10 mrem). This dose (76.95 % of potential groundwater dose) is attributable to Ra-226 (NORM) possibly leached from saprolitic granite since the wells are upgradient of the SRS. Probable NORM is not an SRS contribution to MEI dose, but is included as part of the total dose only because it was greater than the South Carolina background. This dose above the South Carolina background was mostly from shallow wells of <150 feet depth that represent the local NORM dose possible in downgradient private wells or within saprolitic granite. The DOE-SR downriver dose concentration (0.03 mrem average at the downstream water suppliers) was within one standard deviation of the 1999-2006 PWSRW average (0.03 ± 0.02 mrem). However, the dose near SRS was potentially much higher (0.07 mrem SCDHEC to 0.09 mrem DOE-SR data). River water dose is a result of upstream sources, rainwater, and groundwater aquifers (e.g., seeps, springs, and artesian wells) and weather related runoff. The SCDHEC 2006-year ratio of MEI plus NORM to nonNORM dose for groundwater ingestion (1.25/0.15 mrem) indicated that the dose to private wells originating in or downstream of saprolitic granite may be 8 times higher than the typical well water dose because of NORM contributions. Thus, NORM contributions potentially increase the average water dose. The SCDHEC MEI who drank untreated river water near Savannah River boat landings would have received 0.06-mrem or 1.5 % of the DOE and EPA 4-mrem standard in 2006. Any homes still using old cistern water sources would only receive 0.01 mrem of dose with no additional NORM.

The SCDHEC air data was 0.005 mrem and added to the All-Pathway (air plus liquid) dose. The DOE-SR all-pathway dose was based on the MEI near the SRS boundary. The SCDHEC MEI All-Pathway detected maximum dose (river water plus air) was 0.08 mrem compared to the DOE-SR All-Pathway potential dose estimate of 0.20 mrem (WSRC 2007). Thus, DOE-SR calculated estimates for public dose exposure continue to be conservative.

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**Sportsman Pathway**

The 2006 fish average dose (0.26 mrem) and fish MEI dose (0.44 mrem) were greater than the deer average dose (0-mrem) for SCDHEC samples, but less than the deer MEI or maximum dose (1.15 mrem). The 1999-2006 MEI SCDHEC statistics (based on a maximum dose received by a single hunter instead of an average dose) reverse this trend and deer become the dominant dose contributor (9.27 mrem) ( Table 3, Section 6.1.4). Figures 1 and 2, section 6.1.2 show that a trend change can occur when a maximum deer dose was substituted for an average deer dose. Soil beta-gamma exposure (TLD) was the highest media contributor to average dose for SCDHEC in 2006 (Table 1, section 6.1.2), but this dose contains probable NORM above the South Carolina background. The exclusion of probable NORM, beta-gamma, and unknown alpha leaves Cs-137, Sr-89/90, and H-3 as the probable SRS dose contributions. Fish and game animal (deer and hog) alternated between first and second for food dose. Deer always replaced fish as the number one food dose contributor when the MEI maximum deer dose was used instead of the average deer dose. MEI hog dose was second to MEI deer dose when sampled, but DOE-SR estimates indicated that hogs could potentially replace deer as the number one game animal contributor to the sportsman scenario (WSRC 2007). Compare the 1999-2006 SCDHEC MEI deer and hog consumption MEI dose averages (9.27 and 7.08 mrem respectively) to the deer and hog average dose (0.39 and 1.53 mrem, respectively), and to the 0.51 mrem average fish dose. The SCDHEC seven-year (not collected in 1999) MEI deer dose average (9.27 mrem ± 6.52) was based on actual field data (Figure 3, section 6.1.2), and was more than the DOE-SR off-SRS MEI seven-year deer and hog dose estimate averages (7.27 and 5.30 mrem respectively). Both of these DOE-SR deer and hog dose averages for the 1999-2006 period were within one standard deviation of the SCDHEC averages (deer 9.27 mrem ± 6.52, hog 7.08 mrem ± 8.81 respectively). The DOE-SR used a computer model to estimate the dose values to the MEI from the sportsman exposure pathway. Thus, DOE-SR off-SRS deer and hog estimates were conservative compared to average dose, but underestimated the maximum MEI dose detected.

The DOE-SR MEI calculation for fish was based on the fish sample with the highest concentration. SCDHEC based its own fish MEI on the total of the highest radioisotope concentrations, irrespective of species, since the MEI eats all types of fish. Carp had the highest tritium detection average (0.002 mrem), while bass had the highest Cs-137 (0.436 mrem), and catfish had the highest Sr-89/90 (0.001 mrem). The eight-year average of DOE-SR sampled fish (0.49 mrem, ±0.26) was within one standard deviation of the SCDHEC sampled fish average (0.51 mrem, ±0.27) (Table 3, section 6.1.4).

The sportsman comparable media average (Table 2, section 6.1.2) of air, liquid, soil, and food exposure pathways gave a DOE-SR media dose average (2.60 mrem ± 3.28) within one standard deviation of the SCDHEC average (1.40 ± 1.75 mrem), and the medians agreed within a factor of two (1.65/0.94). The potential dose by media pathway was highly variable, but the averages of the four media were within one standard deviation of each other. Also, the DOE-SR estimate of potential dose to the public and the environment were very conservative compared to actual SCDHEC detections except for soil, which included probable NORM detections by SCDHEC.

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The three main routes of dose exposure to the sportsman including probable NORM were ingestion (45.86%), direct external absorption (41.86%), and inhalation (12.28%) in that order. Direct ambient exposure (2.52 plus 0.31 mrem) was the primary dose for the total MEI Sportsman plus NORM Scenario in 2006 (Table 1, section 6.1.2). Next were food ingestion (1.81 plus 0.04 mrem), the drinking water ingestion pathway (0.15 mrem maximum plus 1.10 mrem), and the atmospheric inhalation pathway (0.01 plus 0.82 mrem).

The downward trend of deer dose since 2002 was offset by an upward trend of soil dose due to the use of an outer perimeter background as opposed to a single biased location. This soil dominance was heavily influenced by the potential dose in resuspended soil NORM, and unknown alpha and beta, which were not verified by air filter detections. Beta-gamma detections (TLD) above background could not be ruled out as NORM since some soil gamma detections (Cs-137, Pb-212, Pb-214, Ra-226, and Ac-228) did occur at other locations, and unqualified beta-gamma atmospheric releases were indicated in SRS Environmental Reports. If the unknown soil NORM and beta-gamma detections were excluded, then the dominant dose returns to the food ingestion pathway (MEI deer, fish, milk, and vegetables) followed by the drinking water ingestion pathway, and inhalation. The swamp dwelling MEI resides downriver close to the SRS swamps, kills and eats deer and hogs, and eats fish from the Savannah River, drinks milk from local dairies, and consumes local vegetables. The 2006 SCDHEC highest MEI food pathway dose (Table 1, section 6.1.2) excluding probable NORM was deer (1.15 mrem), fish (0.44mrem), milk (0.20 mrem), and vegetables (0.01 mrem). The combination of 2006 ground exposure factors (Table 2, section 6.1.2) for the SCDHEC sportsman MEI (3.70 mrem) was more than the comparable DOE-SR (3.30 mrem) estimates (WSRC 2007, Table 6-4) due to the inclusion of probable NORM. However, the exclusion of this probable NORM (1.17 mrem) would leave only 2.53 mrem contribution for the MEI and was less than the DOE-SR estimate for potential dose to the off-SRS hunter and farmer. This comparison excluded the DOE-SR feral hog data, since SCDHEC did not sample feral hogs in 2006. The potential NORM dose must be included since it was greater than the South Carolina background for the respective media. The SCDHEC MEI scenario including NORM was 6.76 mrem and less than the DOE-SR Sportsman potential dose estimate of 10.12 mrem (excluding the on-site hunter and off-site hog data) (WSRC 2007, Table 6-4). Thus, SCDHEC detected 66.80% of the DOE-SR estimated dose from these media. This indicated that the DOE-SR dose estimates for 2006 were conservative overall based on radionuclide detections by SCDHEC.

The radioisotopes contributing dose greater than 1% of the total including potential NORM from 1999 through 2006 (Table 2, section 6.1.4) were Cs-137 (42.39 %), unknown beta-gamma (20.97 %), alpha assigned as Pu-239 (17.45 %), Ra-226 (11.10 %), H-3 (1.82%), Sr-89/90 (1.37%), and Ac-228 (1.09%). The exclusion of probable NORM above background contributed by unspecified alpha, beta, Ra-226, Ac-228 and other natural decay series radionuclides would change the major radionuclide contaminant order to Cs-137, H-3, and Sr-89/90 (Table 2, section 6.1.4). Figure 1, section 6.1.2 represents the average (not maximum MEI) dose above background detected in sample media collected for the SCDHEC survey of the SRS perimeter from 1999 through 2006. The highest concentrations for each radioisotope, irrespective of species, were added to represent the maximum possible dose for the media (e.g. fish). SCDHEC (Table 3, section 6.1.4) found that MEI deer consumption contributed the highest MEI media

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dose (65.66%) from 1999 through 2006, hogs (21.49%) second, followed by soil (6.86%, TLD and soil), fish (4.13%), milk (0.57 %), boat landing surface water (0.45 %), Savannah River drinking water (0.26 %), private wells represented by DNRGW (0.22 %), public water supply wells (0.17 %), rainwater (0.09%), air inhalation (0.06 %), and vegetable consumption (0.03%) (Table 3, section 6.1.4 MEI % of all media column).

The deer results in Figure 1, section 6.1.2 were based on an overall average dose minus an average background dose, whereas the MEI deer and hog results in Figure 2, section 6.1.2 were based on a maximum deer and hog dose being consumed by one individual. The highest average pathway dose totals by media pathways (excludes MEI deer and probable NORM) in 2006-year came from direct exposure to all soil (2.53 mrem), fish (0.44 mrem), milk (0.20 mrem), all groundwater (0.19 mrem), all riverwater sources (0.13 mrem), and rainwater, vegetables, and air (0.01 mrem each). The average deer dose in 2006 was less than a high background in the McBee area. Thus, this years dose was less than the typical dose in past years. Yet the overall dose pattern for the period 1999 through 2006 did not change appreciably.

The dose to the MEI for fish has been <1 mrem for both organizations from 2000 through 2006 (Table 3, section 6.1.4). The differences between the SCDHEC deer detections and the DOE-SR estimates were possibly due to the methods of calculating the dose value. The SCDHEC used actual deer data collected from the field, while the DOE-SR used a computer model based on the radionuclide levels in on-SRS deer to calculate a MEI dose exposure value for off-SRS deer. The deer MEI dose value has varied greatly during the past seven years possibly due to numerous diet and weather related factors (resuspension and deposition of radionuclides). The low DOE-SR deer dose in 2001 was due to the limited number of hunts conducted after the September 11, 2001 terrorist attack (WSRC 2002a).

Factors influencing dose estimates included fluctuation of the deer and fish populations due to disease, predation, and available food. Deer, for example, consume certain types of edible mushrooms when available (DuPont 1983). Mushrooms are the number one bioconcentrator of some heavy metals and radioisotopes (Botsch et al. 2000, Kalac 2001). The availability of these mushrooms may be determined by factors that enhance or reduce radionuclide concentrations (e.g. controlled burns, deforestation, and weather). It may be possible in the future to correlate Cs-137 peak concentrations that occur in mushrooms and deer with weather and/or resuspension activities (controlled burns).

Other game-animals (e.g., feral hogs) are harvested by sportsmen, but SCDHEC does not have hog data (2006) to compare with the DOE-SR hog data. Also, the 2006 SCDHEC sportsman MEI scenario gave a total dose of 6.76 mrem that did not include off-SRS feral hogs (8.9 mrem) (WSRC 2007). Thus, the potential MEI dose can be higher (6.76 plus 8.9 equals 15.66 mrem) than that cited by SCDHEC for the offsite MEI sportsman comparison. The potential MEI dose could be even higher, if other game were included. The worst-case scenario estimations by the DOE-SR (6.7 mrem in 2006) for MEI deer dose were usually very conservative compared to the SCDHEC MEI deer dose (1.15 mrem in 2006), (Table 3, section 6.1.4). The MEI deer hunter maximum exposure was always several times higher than the average deer dose, which means

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that a small sample set using the maximum detection should provide a conservative estimate of dose to the average deer hunter. The offsite DOE-SR and SCDHEC deer and fish dose estimates are shown in Section 6.1.2, Figure 3 for comparison to the potential onsite dose. The two programs detected the same trend changes (Figure 3, section 6.1.2).

The DOE-SR onsite hunter deer dose (average 38.84 mrem ± 27.29, median 30.75) is decreasing and approaching the offsite deer dose, which shows less variability and is averaging 7.27 mrem ± 5.57 (median 6.20 mrem) for WSRC estimates and 9.27 mrem ± 6.52 (median 7.64 mrem) for SCDHEC detections. The fish dose is steady within one standard deviation of DOE-SR and averaging 0.49 mrem ± 0.26 (median 0.47 mrem) for WSRC data and 0.51 mrem ± 0.27 (median 0.44 mrem) for SCDHEC detections.

Deer Meat Dose Results

The DOE-SR off-SRS MEI deer hunter dose (WSRC 2007, Table 6-4) was estimated from the on-SRS deer dose. The DOE-SR total off-SRS estimated deer hunter dose (6.7 mrem) plus soil exposure (2.9 mrem) was 9.6 mrem. The on-SRS average hunter dose (DOE-SR, 22 mrem) and the lower off-SRS detected deer dose (9.6 mrem) totals 31.60 mrem. The SCDHEC detected offsite MEI deer dose (1.15 mrem) plus a soil exposure dose (2.53 mrem) that excluded NORM was 3.68 mrem. The differences between onsite and offsite dose may be due to the available food in each habitat, the food source uptake due to soil characteristics, and the contamination contained in that vegetation. The 2006-year average of the DOE-SR estimated off-SRS MEI deer dose (WSRC 2007, Table 6-4) without soil exposure (6.7 mrem) and the SCDHEC off-SRS observed MEI deer dose (1.15 mrem) was 3.93 mrem. Both estimates were less than the average exposure from living in a brick house for one year (7mrem)(SCDHEC 2006f). The 1999-2006 SCDHEC SRS 50-Mile Perimeter MEI average yearly deer dose was 9.27 mrem (±6.52).

The most contaminated SCDHEC deer sample resulted in 1.15 mrem (Figure 3, section 6.1.2) of dose for the 2006-year single hunter MEI. However, the offsite SCDHEC deer average dose dropped to zero due to a high background in the McBee area. This high background may be due to past nuclear test fallout depositions of Cs-137 in the area, the local commercial nuclear facility, or local soil chemistry and plant uptake factors. The gradual decrease in onsite deer dose may be a function of decreased hunts and kills onsite in recent years. The DOE-SR and SCDHEC MEI deer dose averages for 1999-2006 were within one standard deviation of each other (SCDHEC did not collect deer samples in 1999). Also, the onsite deer dose is decreasing steadily (Figure 3, section 6.1.2) toward the offsite deer dose level. The SCDHEC MEI deer dose excluding NORM was 25.61% of the SCDHEC MEI total offsite dose in 2006.

Total MEI Dose

The DOE-SR data for the MEI came from the SRS Environmental Report for 2006 (WSRC 2007). Table 2, section 6.1.2 shows similar media and pathway dose that were used to compare the SCDHEC sportsman MEI scenario with DOE-SR MEI potential dose data. Table 1, section 6.1.2 totals are different than the Table 2 section 6.1.2 totals, since all media were not used in Table 2. The total MEI dose for the swamp-dwelling survivalist who was a sportsman and

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consumed the maximum deer dose and other dose (possible NORM) was 6.76 mrem. The total exposure to the average sportsman consuming the average deer dose was only 3.34 mrem in 2006 (Table 3, section 6.1.4). The average of comparable media doses in Table 2, section 6.1.2, SCDHEC and DOE-SR, was 2.00 mrem ± 2.51. Either programs multimedia average was within one standard deviation of the other. This demonstrates that the average media dose projected by the two environmental programs (SCDHEC detections versus DOE-SR calculations) captured similar environmental data. However, a large standard deviation in comparison to the average may indicate that more sampling was needed. Alternately, a high standard deviation may simply represent a highly variable environmental parameter for a particular media. The median may be a better indicator of the dose central tendency in highly variable environmental data if the sampling number is sufficiently large. Thus, the typical exposure for a member of the general public who was a sportsman may be less than 2.32 mrem (1999-2006 Average Sportsman median, Table 1, section 6.1.4).

Four dose scenario estimates were calculated based on SCDHEC data from 1999 to 2006 (Table 1, section 6.1.4 and Table 3, section 6.1.2). The worst-case MEI dose exposure in 2006 that excludes possible NORM above the South Carolina background was 4.49 mrem and averaged 12.28 mrem ± 11.54 (median 9.62 mrem) from 1999 to 2006. The average sportsman who was not the MEI was exposed to 3.34 mrem of dose in 2006 and averaged 2.42 mrem ± 1.76 (median 2.32 mrem) from 1999 through 2006. The farmer, who was not a hunter, but inhaled, ingested, or received direct exposure from soil received a dose of 2.90 mrem in 2006 and averaged 0.96

mrem ± 1.26 (median 0.11 mrem) from 1999 through 2006. The general public who was not a sportsman and was not exposed to swamp soils received less than 0.37 mrem of dose in 2006 and averaged 0.13 mrem ± 0.12 (median 0.09 mrem) from 1999 to 2006.

The four SCDHEC conservative scenarios for public exposure to radionuclides are summarized in Table 3, section 6.1.2 as millirem (mrem) of dose exposure, which excludes possible NORM. Note that two-standard deviations (95% probability) added onto the MEI Sportsman (worst-case scenario) result in a possible dose average of 35.36 mrem from 1999 to 2006. A potential dose addition based on the DOE-SR onsite hunter (22 mrem) and offsite feral hog (8.9 mrem) estimates added to the offsite SCDHEC detected nonNORM dose (4.49 mrem) would increase the potential onsite plus offsite dose estimate to 35.39 mrem in 2006. Thus, the additional DOE-SR calculated dose-potential for game not sampled by SCDHEC added to the 2006 SCDHEC off-SRS MEI deer dose (35.39 mrem) fits the two-standard deviation (35.36 mrem) trend indicated by the SCDHEC 1999-2006 data. Both potential increases in the MEI are under the DOE standard of 100 mrem. Thus, the two programs environmental monitoring sections are capturing similar MEI dose and trends (Figure 3, section 6.1.2). The food pathways dominate the dose to the sportsman MEI, and either the deer or fish dose may dominate in a particular year on an average dose basis. The primary cause of this fluctuation was apparently due to the variability in deer radionuclide concentration.

The DOE-SR potential air dose from Table 2, section 6.1.2 is 1.1% of the DOE 10 mrem air standard. The DOE-SR potential liquid dose at the site boundary is 2.25 % of the EPA 4 mrem drinking water standard.

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The total SCDHEC detected dose (includes probable NORM) for the sportsman scenario from all pathways (approximately 6.76 mrem) gives a dose that is 6.76 % of the 100 mrem DOE standard for allowable dose to the public and environment. The SCDHEC 2006 air (0.10 % of 10 mrem air standard) and liquid (Savannah River water 1.75 % of 4 mrem public water supply standard) dose estimates were well within the respective 10 mrem and 4 mrem DOE/EPA limits.

The potential total dose to the SCDHEC MEI was very small when compared to radiation doses received from natural sources (6.76 versus 300-mrem), which is 2.25 % of the average NORM dose in the southeastern United States. Approximately 33.58% (2.27 mrem) of the MEI plus NORM dose detection was potential NORM.

The SCDHEC detected air dose was only 0.005-mrem compared to the DOE-SR calculated potential air dose of 0.07 mrem, which indicated that depositions of the possible DOE-SR aerial contamination within the 50-mile SRS perimeter were minimal. Thus, most of the aerial

depositions were either very close to the release stacks and within the SRS boundary or outside of the SRS 50-Mile sampling perimeter.

The SCDHEC calculated average dose (mrem/yr) to the MEI for the past eight years is graphed in Figure 1, section 6.1.2 and the summary statistics given in section 6.1.4. The MEI dose became highly variable when the game animal dose was added. The greatest difference between SCDHEC and DOE-SR 2006 average dose results occurred in the game animal pathway (SCDHEC zero mrem and DOE-SR 6.7 mrem). This was due to a South Carolina background deer dose average greater than the SRS 50-Mile sampling perimeter dose for SCDHEC samples.

The DOE-SR off-SRS deer dose estimate was based on deer on-SRS moving off-SRS. Comparatively, the SCDHEC used only detected data collected from actual monitoring activities to establish dose for the detected radioisotopes. DOE-SR used all calculated data per DOE approved procedures whether negative or less than an MDA or MDC. The actual SCDHEC off-SRS MEI dose including NORM (6.76 mrem) was less than the DOE-SR (9.6 mrem) total off-SRS estimated deer dose (WSRC 2007, Table 6-4). The similarity (within one standard deviation) of the average dose estimates for the 1999-2006 SCDHEC (9.27 mrem) and DOE-SR (7.27 mrem) data seemed to indicate that the two programs are detecting the potential dose to the public and the environment.

When comparing the total dose to the MEI from SRS operations, it is important to be aware of the total dose received each year from naturally occurring radiation. Figure 4, section 6.1.2 depicts the average total doses received each year by people living in the Southeastern Region of the U.S. (composite from SCDHEC 2005 website). The SCDHEC MEI received 4.49 mrem (6.76 mrem including probable NORM) in 2006, which was less than that received by the individual living in a brick house (7 mrem).

The median may be a better indicator of the central tendency in environmental dose due to: 1- the reduction of influence by the extremes; 2- the added conservancy present in selected dose factors; 3- the addition of dose based on hog and deer worst-case game animal consumption; 4- the use of “detections only” for statistics when many sample results were less than the detection

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limit; 5- the counting of some dose twice when a particular alpha or beta was counted by species; and 6 – the assignment of unknown alpha and beta as Pu-239 and Sr-90 in dose calculations. Thus, the reader is referred to the median in all statistical tables as possibly a more realistic representation of the central tendency of dose. However, the average was used by SCDHEC to provide a protective buffer for the public and the environment.

The total detected dose to the MEI of 6.76 mrem in 2006 should also be compared to the Health Physics Society 1994 Position Statement (Health Physics Society 1994), which states in part that "for purposes of a lifetime risk, a site-specific dose rate of 10-30 mrem/yr greater than the regional average is well within the natural variations of background and should be considered equivalent to background without demonstrable increased risk". However, statistical analysis of future SCDHEC random data may demonstrate if the assumption, that the SRS 50-Mile Perimeter and South Carolina background radionuclide populations are the same, can be rejected.

## CONCLUSIONS AND RECOMMENDATIONS

The SCDHEC MEI Sportsman detected dose including potential NORM was 6.76 mrem in 2006 and averaged 13.49 mrem ± 12.99 (median 10.22 mrem) over the last eight years. The SCDHEC MEI Sportsman detected dose excluding potential NORM was 4.49 mrem in 2006 and averaged 12.28 mrem ±11.54 (median 9.62 mrem) from 1999 to 2006. The maximum potential dose to the MEI All-Pathway and Sportsman doses calculated by DOE-SR (WSRC 2007, Table 6-4) could have added 22 mrem for the on-SRS hunter plus 8.9 mrem for the off-SRS hog hunter to the SCDHEC 2006 MEI dose estimate. Thus, the potential MEI dose to the sportsman (including other air and liquid pathway dose detections by SCDHEC) that takes part in SRS area deer and hog hunts on or off site was less than 37.66 mrem in 2006 (6.76 plus 30.9). The DOE-SR 2006 MEI on-SRS and off-SRS hunter dose potential estimate totaled 40.5 mrem (WSRC 2007, Table 6-4). The very conservative worst-case scenario estimates average less than half of the 100-mrem DOE limit (WSRC 2007). The maximum MEI was not established by SCDHEC samples since hog data from SRS indicated there may be other significant contributors to the overall MEI pathway that are not yet surveyed by SCDHEC.

Three other dose scenario estimates were calculated based on SCDHEC data from 1999 to 2006 (Table 3, section 6.1.4). The average sportsman who was not the MEI was exposed to 3.34 mrem of dose in 2006 and averaged 2.42 mrem ± 1.76 (median 2.32 mrem) from 1999 to 2006. The farmer, who was not a hunter, but inhaled, ingested, or received direct exposure from soil and well water received a dose of 2.90 mrem in 2006 and averaged 0.96 mrem ±1.26 (median 0.11 mrem) from 1999 through 2006. The general public, who was not a sportsman and was not exposed to swamp soils received less than 0.37 mrem of dose in 2006 and averaged 0.13 mrem ± 0.12 (median 0.09 mrem) from 1999 to 2006.

Historically, the greatest media contributors to the MEI average dose determined by SCDHEC from 1999 thru 2006 (Table 3, section 6.1.4 , % All Media) that excluded possible NORM were deer (65.66%), hog (21.49%), soil and sediment (6.86%, includes beta-gamma), fish (4.13%), milk (0.57%), all surface water (0.45%), all groundwater (0.39%), rainwater (0.09%), air (0.06%), and vegetables (0.03%). The main radionuclide contributors to dose (Table 2, section 6.1.4) excluding possible NORM above background from 1999 to 2006 were Cs-137 (42.39%),
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H-3 (1.82%), Sr-89/90 (1.37%), and others less than 1%. The addition of possible NORM changed the significant (greater than 99 % of dose) radionuclide order from 1999 through 2006 to Cs-137, unknown beta-gamma, unknown alpha, Ra-226, H-3, Sr-89/90, and Ac-228. Possible NORM was included in the averages when there were media detections above background not invalidated by other media information. NORM contributed approximately 33.58% (2.27/6.76) of the dose detected by SCDHEC in 2006 (Table 1, section 6.1.2, MEI plus NORM). The 2006 critical pathway dose excluding NORM was ingestion (43.65%), direct exposure (56.12%), and inhalation (0.22%). When probable NORM detected above background was included ingestion dominated the 2006 MEI dose (45.86%), direct exposure was second (41.86%), and inhalation was third (12.28%). This local NORM above the South Carolina background may be part of the 300-mrem NORM average for the United States.

The similarity of the compared data statistics (typically within one standard deviation) for DOE-SR and SCDHEC dose data appeared to confirm that both environmental programs were detecting similar magnitudes of dose that were within regulatory standards (WSRC 2007).

The SCDHEC Dose Calculation Project will continue to monitor the MEI and other scenario dose trends. The Sportsman MEI scenario should include all potential doses as a worst-case scenario. SCDHEC continues to expand the ESOP environmental program by collecting additional random SRS perimeter and South Carolina background data for statistical analyses in future studies. ESOP has increased sampling near the perimeter of SRS and in closer proximity to SRS storage tanks, basins, and seepage areas to insure an early warning for any contaminant making its way to the SRS and offsite streams.

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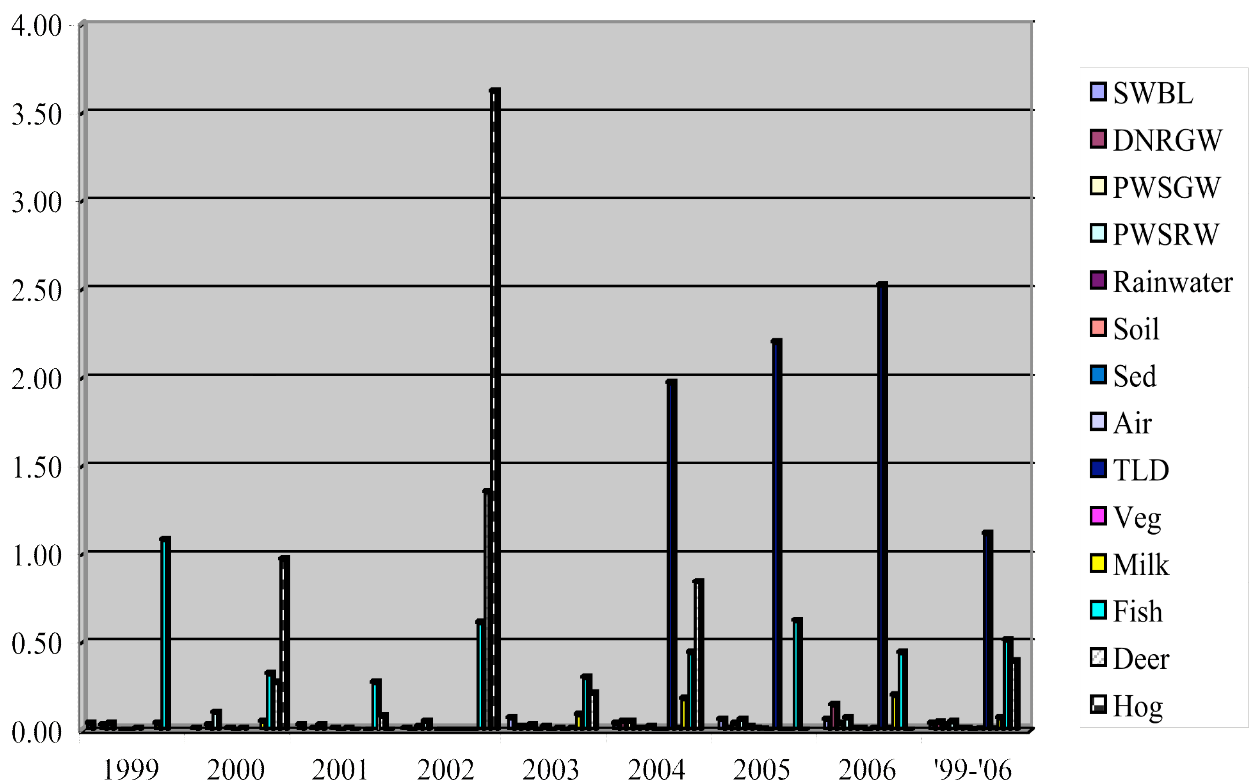
### 6.1.2 Tables and Figures
### Radiological Dose Calculation

**Figure 1. SRS 50-Mile Perimeter Media Dose (mrem) 1999-2006 Excluding Probable NORM**




Notes: The Figure 1 data are in millirem per year and are based on averages from data in Appendix C.
1. "RW" is public water systems using river water.
2. "GW" is public water systems using groundwater.
3. "SWBL" is surface water at boat landings.
4. "DNR" is the Department of Natural Resources monitoring wells.
5. "Sed" is sediment.
6. "Veg" is vegetation.
7. TLD is the direct exposure above background detected by thermoluminescent dosimeters.
8. The deer and hog results in Figure 1 were based on an overall average dose minus an average background dose, whereas the MEI deer and hog results in Figure 2 were based on a maximum deer dose being consumed by one individual.
9. The '99-06' is the average dose for that media for the period 1999-2006. Consult Appendix B for the average media dose by species or radionuclide.
10. Errors occurred in past soil data and are corrected in this chart and appendix tables.

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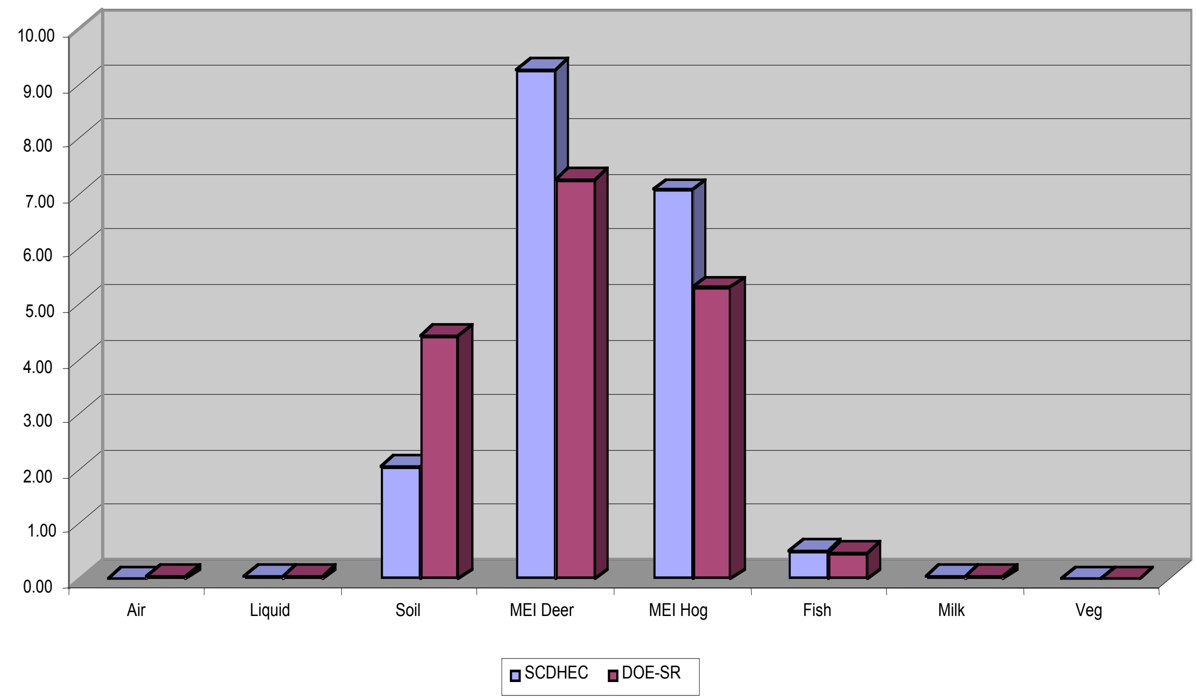
Figure 2. Comparison of the 1999-2006 Media Pathway Dose (mrem) for the SRS Perimeter




Notes:
1. The air pathway refers to MEI air inhalation.
2. The liquid pathway refers to the MEI ingestion for downriver water customers.
3. The food pathway (deer, fish, milk, and vegetables) may be influenced by both air and liquid pathway sources.
4. The SCDHEC MEI deer and hog offsite results were based on a single maximum dose for one hunter, whereas the DOE-SR offsite results were based on a MAXDOSE computer model.
5. The deer and hog results in Figure 1 were based on an overall average dose minus an average background dose, whereas the MEI deer and hog results in Figure 2 were based on a maximum deer dose being consumed by one individual.

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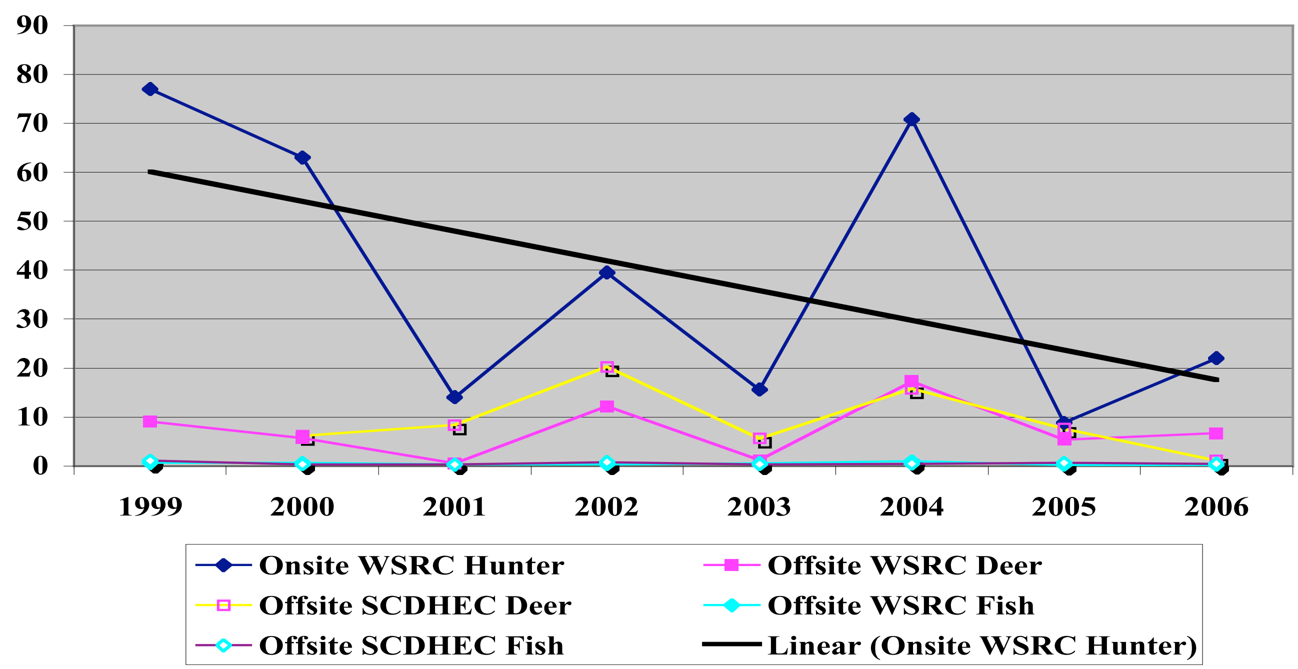
**Figure 3. SCDHEC and DOE-SR Sportsman Dose (mrem) Comparison**




Notes:

1. When WSRC reports for DOE-SR showed a trend change, SCDHEC did also.
2. Three trends are illustrated overall: the onsite hunter deer dose is decreasing and approaching the offsite deer dose; the DOE-SR and SCDHEC offsite deer and fish dose are steady and within one standard deviation.
3. “Mrem” is milliroentgen equivalent man dose unit.
4. The compared doses represent the average fish and MEI deer dose.
5. Reference WSRC reports and data from 1999 through 2006.
6. “Linear” is the least squares linear trend line for the onsite WSRC hunter data points.

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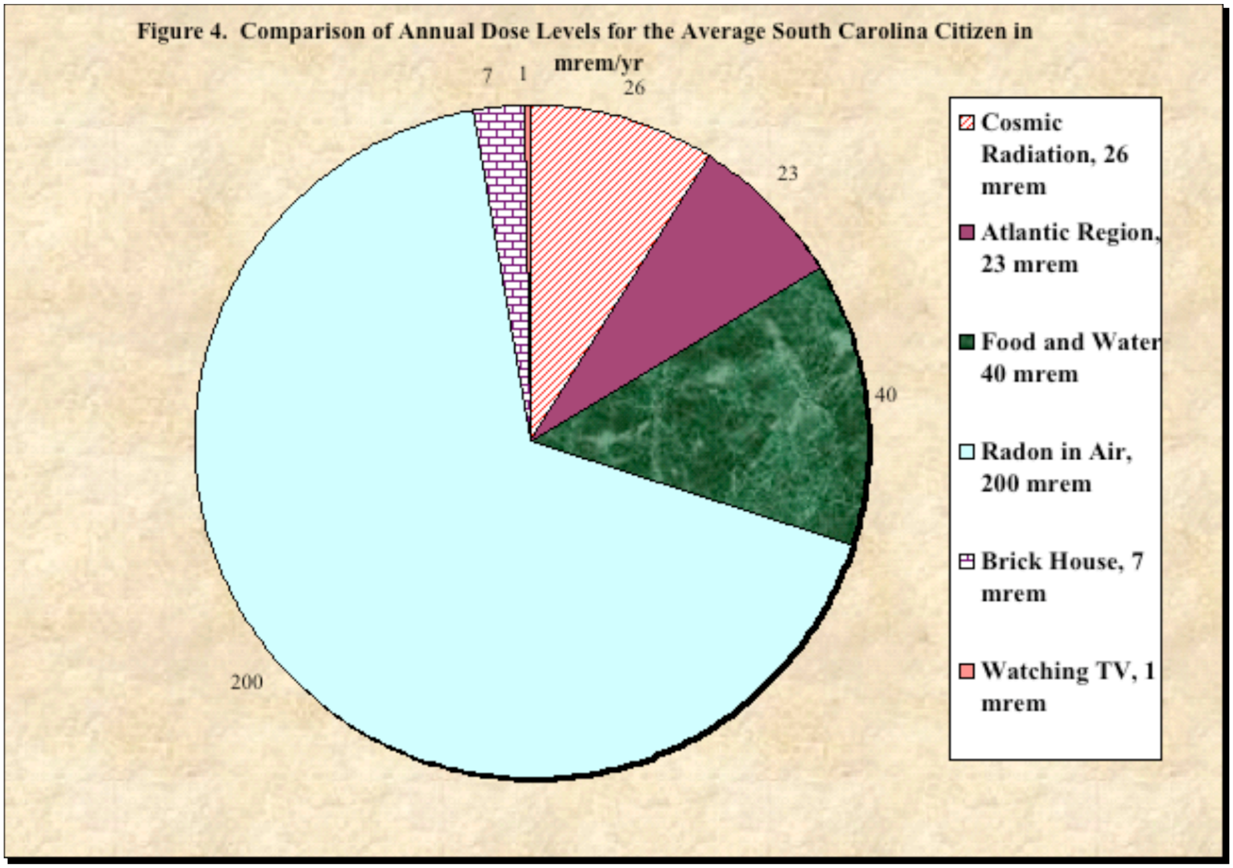
## Tables and Figures
## Radiological Dose Calculation




Notes:
1. Composite of dose levels from the SCDHEC (2006e) internet site http://www.scdhec.net/environment/water/radium.htm.
2. These pie sections represent relative dose levels only.

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## Tables and Figures
## Radiological Dose Calculation

Table 1. 2006 SCDHEC Dose (mrem[1]) Estimates for Exposure Routes, Pathways, and Media

| Exposure Routes | Pathways | | Media | MEI Dose (mrem) | +NORM[2] |
|---|---|---|---|---|---|
| **MEI Inhalation** | Air | | Air | **0.01** | |
| **0.22% of Dose** | Resuspended Soil[4] | | | **0.00** | **0.82** |
| | Resuspended Sediment | | | **0.00** | |
| | **Total Dose - Air Inhalation (12.28% of Dose)** | | | **0.01** | |
| **MEI Ingestion** | Food | | Fish | **0.44** | |
| **43.65% of Dose** | | | Deer avg (0.00-mrem) | **1.15** | |
| | | | Hog | | |
| | | | Vegetable | **0.01** | |
| | | | Milk | **0.20** | |
| | Soil | | Soil | **0.01** | **0.04** |
| | Sediment | | Sediment | **0.00** | |
| | **Total Dose - Food Ingestion (27.37% of Dose)** | | | **1.81** | |
| | Water | Potable | PWS River Water | 0.07 | |
| | | | PWS Wells | 0.04 | |
| | | | DNR Wells[5] | **0.15** | **1.10** |
| | | Nonpotable | Swamp/SW[3] | 0.06 | |
| | | | Rainwater | 0.01 | |
| **MEI** | **Total Dose-DW Ingestion (18.49% of Dose)** | | | 0.33 | |
| **Direct Exposure** | Air | Cloud | Submersion | | |
| **56.12% of Dose** | | Skin | Absorption | | |
| | Water | Swimming | Immersion | 0.00 | |
| | | Skin | Absorption | 0.00 | |
| | Soil | Ground | Shine[6] | 0.00 | **0.31** |
| | | TLD | Absorption | **2.52** | |
| | Sediment | Shoreline | Shine | 0.00 | |
| | **All Direct Total Exposure (41.86% of Dose)** | | | **2.52** | |
| **Total Offsite Dose - All Pathways** | | | | **4.49** | **2.27** |
| | | | | MEI plus NORM Dose | **6.76** |

Notes:
1. All abbreviations are defined in the acronyms and data in bold represents the MEI maximum value.
2. Probable NORM dose detections are considered separately from SRS perimeter dose.
3. Only one drinking water source assignable per scenario.
4. Resuspended soil alpha from six-inch average depth was not backed up by air filter detections.
5. Most of the GW dose was from Ra-226 (U-238 natural decay series), and upgradient of SRS.
6. Most of the direct exposure dose was from unknown beta-gamma around the perimeter of SRS.
7. MEI dose% are based on 4.49mrem detection and Total Dose% are based on 6.67mrem.
8. MEI % Dose example – Ingestion dose for MEI (bold number) is (1.81+0.15)/4.49*100 % or 43.65%.
9. Total Dose % - Direct dose for MEI plus NORM (total) is (2.52+0.31)/6.76*100% or 41.86%.

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## Tables and Figures
## Radiological Dose Calculation

**Table 2. SCDHEC and DOE-SR Dose Results for Survivalist-Sportsman MEI**

| Environmental Monitors - 2006 | SCDHEC | | | | DOE-SR (1) | | | |
|---|---|---|---|---|---|---|---|---|
| Pathways - - - - - - - Media and Dose | Air | Liquid | Soil | Food | Air | Liquid | Soil | Food |
| Water | | 0.07 | | | | 0.09 | | |
| Inhalation | 0.01 | | | | 0.11 | | | |
| Combined Soil | | | 3.70 | | | | 3.18 | |
| Swimming | | 0.00 | | | | 0.00 | | |
| Boating | | 0.00 | | | | 0.00 | | |
| Milk | | | | 0.20 | | | | 0.01 |
| Edible Vegetation | | | | 0.01 | | | | 0.05 |
| Creek Mouth Fish | | | | 0.44 | | | | 0.24 |
| Offsite Deer | | | | 1.15 | | | | 6.70 |
| Totals | 0.01 | 0.07 | 3.70 | 1.80 | 0.11 | 0.09 | 3.18 | 7.00 |
| 2006 MEI Comparison | Pathways | | | | Summary Statistics | | | |
| Totals | Air | Liquid | Soil | Food | Totals | Avg.(4) | sd (5) | Median |
| SCDHEC | 0.01 | 0.07 | 3.70 | 1.80 | 5.58 | **1.40** | *1.75* | 0.94 |
| DOE-SR | 0.11 | 0.09 | 3.18 | 7.00 | 10.38 | **2.60** | *3.28* | 1.65 |
| Averages of Programs | 0.06 | 0.08 | 3.44 | 4.40 | 7.98 | 2.00 | 2.51 | 1.29 |
| Standard Deviation | 0.07 | 0.01 | 0.37 | 3.68 | 3.39 | 0.85 | 1.08 | 0.50 |
| % of standard (6) | **0.30** | **1.75** | | | | | | |

Notes:

1. The DOE-SR estimates of dose to the MEI come from the Savannah River Site Environmental Report for 2006, WSRC-TR-2007-00008.
2. All dose results not shown were well below the significant figure standard.
3. The combined soil reflects dose from swamp and creek bank soil plus possible NORM.
4. Avg is average.
5. Sd is standard deviation.
6. % is percent of EPA and DOE air (10 mrem) and liquid (4 mrem) standards.
7. Inhalation from resuspended soil was included in the SCDHEC soil category, since inhalation of suspended soil was not likely in wet flood plain soil.
8. The SCDHEC combined soil category included ingestion, direct exposure, and resuspended inhalation of soil and direct exposure detected by TLD.

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## Tables and Figures
## Radiological Dose Calculation

**Table 3. SCDHEC Potential Dose Scenarios**

| | 2006 | 1999-2006 | | |
|---|---|---|---|---|
| | | Average | Standard Deviation | Median |
| MEI [1] Sportsman | 4.49 | 12.28 | 11.54 | 9.62 |
| Public[2] | 0.37 | 0.13 | 0.12 | 0.09 |
| Farmer [3] | 2.9 | 0.96 | 1.26 | 0.11 |
| Average[4] Sportsman | 3.34 | 2.42 | 1.76 | 2.32 |

Notes: NORM was excluded.

1. The maximum exposed individual (MEI) is the worst-case scenario for a single hunter that also uses the worst-case ingestion dose from all sampled water sources.
2. The non-sportsman public dose deletes sports food, sediments, and soil and adds the highest public or private water source dose.
3. The farmer scenario adds the sediments, soil, and highest well water dose to #2.
4. The average sportsman replaces the MEI deer dose with average deer dose and uses the highest public or private water source dose.

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### 6.1.3 Data

### Radiological Dose Calculation Data



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## 6.1.4 Data

## Radiological Dose Calculation Data

**Table 1. 1999 MEI Radiation Dose**

| Project | Isotope | Average Activity | Background Activity | Net Activity | Max Consump Rate | Average Act w/ Max Consump. | Subtotal Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | mrem |
| **Fish Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **1.08** |
| | H-3 | 4.970E+00 | 0.000E+00 | 4.970E+00 | 48.2 | 0.015 | 1.075 | |
| | Cs-137 | 4.400E-01 | 0.000E+00 | 4.400E-01 | 48.2 | 1.060 | | |
| **Milk Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.04** |
| | H-3 | 3.850E-02 | 0.000E+00 | 3.850E-02 | 230 | 0.001 | 0.043 | |
| | Cs-137 | 3.670E-03 | 0.000E+00 | 3.670E-03 | 230 | 0.042 | | |
| | Sr-90 | 7.200E-04 | 2.270E-03 | -1.550E-03 | 230 | -0.004 | | |
| **DW Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | ***3** |
| PWSRW | H-3 | 9.337E+02 | 2.580E+02 | 6.757E+02 | 730 | 0.032 | 0.032 | |
| **Rainwater** | H-3 | 5.860E+02 | 2.460E+02 | 3.400E+02 | 730 | 0.016 | 0.016 | |
| **Air Inhalation** | | pCi/m$^3$ | pCi/m$^3$ | pCi/m$^3$ | m3/yr | mrem | mrem | **0.02** |
| | H-3 | 0.000E+00 | 4.350E+00 | -4.350E+00 | 8000 | -0.002 | | |
| | UnkAlpha*1 | 0.000E+00 | 4.000E-03 | -4.000E-03 | 8000 | -9.873 | | |
| | UnkBeta*2 | 0.000E+00 | 2.000E-02 | -2.000E-02 | 8000 | -0.208 | | |
| | Sr-89,90 | 1.000E-03 | 0.000E+00 | 1.000E-03 | 8000 | 0.010 | | |
| | U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8000 | 0.000 | | |
| | U-238 | 1.550E-05 | 0.000E+00 | 1.550E-05 | 8000 | 0.015 | | |
| **TLD Direct b-G** | b-G | mrem/day | mrem/day | mrem/yr | hrs/day | mrem | mrem | **0.00** |
| | *4 | 1.820E-01 | 1.980E-01 | 0.000E+00 | 24 | 0.000 | 0.000 | |
| **Soil** | | pCi/g | pCi/g | pCi/g | mg/day | mrem | mrem | **0.00** |
| Ingestion | Cs-137 | 7.250E-01 | 1.900E-01 | 5.350E-01 | 100 | 0.001 | 0.003 | |
| | | | | | hrs/yr | mrem | | |
| Direct | Cs-137 | 7.250E-01 | 1.900E-01 | 5.350E-01 | 4380 | 0.002 | | |
| | | | | | m3/yr | mrem | | |
| Resuspension | Cs-137 | 7.250E-01 | 1.900E-01 | 5.350E-01 | 8000 | 0.000 | | |
| **Surface Water** | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | mrem | |
| Swimming Ingestion | H-3 | 1.054E+03 | 2.380E+02 | 8.160E+02 | 91 | 0.000 | 0.000 | |
| Exposure | UnkAlpha*1 | 4.500E-01 | 1.590E+00 | 0.000E+00 | 91 | 0.000 | | |
| | UnkBeta*2 | 0.000E+00 | 2.860E+00 | 0.000E+00 | 91 | 0.000 | | |
| | Cs-137 | 0.000E+00 | | | 91 | 0.000 | | |
| Boating Exposure | H-3 | 1.054E+03 | 2.380E+02 | 8.160E+02 | 192 | 0.000 | 0.000 | |
| | UnkAlpha*1 | 4.500E-01 | 1.590E+00 | 0.000E+00 | 192 | 0.000 | | |
| | UnkBeta*2 | 0.000E+00 | 2.860E+00 | 0.000E+00 | 192 | 0.000 | | |
| | Cs-137 | 0.000E+00 | | | 192 | 0.000 | | |
| **Boat Landings Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | | **0.04** |
| MEI Drinking Water) | H-3 | 1.054E+03 | 2.380E+02 | 8.160E+02 | 730 | 0.038 | 0.038 | |
| | UnkAlpha*1 | 4.500E-01 | 1.590E+00 | 0.000E+00 | 730 | 0.000 | | |
| | UnkBeta*2 | 0.000E+00 | 2.860E+00 | 0.000E+00 | 730 | 0.000 | | |
| | Cs-137 | 0.000E+00 | | | 730 | 0.000 | | |
| **Sediment** | | pCi/g | pCi/g | pCi/g | hrs/yr | mrem | mrem | **0.00** |
| Shoreline | Cs-137 | 5.400E-01 | 3.500E-02 | 5.050E-01 | 4380 | 0.000 | 0.000 | |
| | | | | | | | | |
| **Groundwater** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | **0.00** |
| Ingestion | H-3 | 3.050E+02 | 3.630E+02 | 0.000E+00 | 730 | 0.000 | 0.000 | |
| | | | | | Total Radiation Detections | | 1.207 | |
| | | | | | **Total MEI Radiation Dose** | | | **1.18** |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers)
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem fo
1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and wate
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

**Table 2. 2000 MEI Radiation Dose**

| Project | Isotope | Average Activity | Background Activity | Net Activity | Max Consump. Rate | Average Act w/ Max Consump. | Subtotal Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **mrem** |
| **Fish Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.32** |
| | H-3 | 2.510E+00 | 0.000E+00 | 2.510 | 48.2 | 0.008 | 0.320 | |
| | Cs-137 | 1.300E-01 | 0.000E+00 | 0.130 | 48.2 | 0.313 | | |
| **Milk Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.05** |
| | H-3 | 3.820E-02 | 0.000E+00 | 0.038 | 230 | 0.001 | 0.054 | |
| | Cs-137 | 4.600E-03 | 0.000E+00 | 0.005 | 230 | 0.053 | | |
| **DW Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | ***3** |
| PWSRW | H-3 | 9.180E+02 | 2.580E+02 | 660.000 | 730 | 0.031 | 0.031 | |
| | UnkAlpha*1 | 2.760E+00 | 3.500E+00 | 0.000 | 730 | 0.000 | | |
| **Rainwater** | H-3 | 4.410E+02 | 3.340E+02 | 107.000 | 730 | 0.005 | 0.005 | |
| **Air Inhalation**[8] | | $pCi/m^3$ | $pCi/m^3$ | $pCi/m^3$ | m3/yr | mrem | mrem | **0.01** |
| | H-3 | 1.308E+01 | 6.106E+00 | 0.000 | 8000 | 0.000 | | |
| | UnkBeta*2 | 1.000E-03 | 2.000E-02 | 0.000 | 8000 | 0.000 | | |
| | U-238[8] | 1.070E-05 | 0.000E+00 | 0.000 | 8000 | 0.010 | | |
| **TLD b-G** | b-G | mrem/day | mrem/day | mrem/yr | hrs/day | mrem | mrem | **0.00** |
| | | 1.810E-01 | 1.980E-01 | 0.000 | 24 | 0.000 | 0.000 | |
| **Soil** | | pCi/g | pCi/g | pCi/g | mg/day | mrem | mrem | |
| Ingestion | Pu-239/240 | 5.300E-02 | 2.000E-02 | 0.033 | 100 | 0.001 | 0.001 | **0.01** |
| | | | | | hrs/yr | mrem | | |
| Direct | Pu-239/240 | 5.300E-02 | 2.000E-02 | 0.033 | 4380 | 0.000 | | |
| | | | | | m3/yr | mrem | | |
| Resuspension | Pu-239/240 | 5.300E-02 | 2.000E-02 | 0.033 | 8000 | 0.008 | | |
| **Surface Water** | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | mrem | |
| Swimming Ingestion & | H-3 | 9.955E+02 | 2.380E+02 | 757.540 | 91 | 0.000 | 0.010 | |
| Exposure | UnkAlpha*1 | 2.780E+00 | 1.590E+00 | 1.190 | 91 | 0.010 | | |
| | UnkBeta*2 | 3.738E+00 | 2.860E+00 | 0.878 | 91 | 0.001 | | |
| Boating Exposure | H-3 | 9.955E+02 | 2.380E+02 | 757.540 | 192 | 0.000 | | |
| | UnkAlpha*1 | 2.780E+00 | 1.590E+00 | 1.190 | 192 | 0.000 | | |
| | UnkBeta*2 | 3.738E+00 | 2.860E+00 | 0.878 | 192 | 0.000 | | |
| **Boat Landing Ingestion** | | pCi/g | pCi/g | pCi/g | L/yr | mrem | 0.088 | **0.09** |
| (MEI Drinking Water) | H-3 | 9.955E+02 | 2.380E+02 | 757.540 | 730 | 0.035 | | |
| | UnkAlpha*1 | 2.780E+00 | 1.590E+00 | 1.190 | 730 | 0.045 | | |
| | UnkBeta*2 | 3.738E+00 | 2.860E+00 | 0.878 | 730 | 0.008 | | |
| **Sediment** | | pCi/g | pCi/g | pCi/g | hrs/yr | mrem | mrem | **0.00** |
| Shoreline | Cs-137 | 2.750E-01 | 3.500E-02 | 0.240 | 4380 | 0.000 | 0.000 | |
| **Groundwater** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | |
| Ingestion | H-3 | 3.900E+02 | 3.630E+02 | 27.000 | 730 | 0.001 | 0.001 | |
| | | **Dose** | | **Background** | | **Net Dose** | | |
| **Game Animal** | | mrem | | mrem | | mrem | mrem | |
| Average Deer Ingestion | Cs-137 | 9.800E-01 | | 0.710 | | 0.270 | | |
| MEI Deer Ingestion | Cs-137 | 6.890E+00 | | 0.710 | | 6.180 | 6.180 | **6.18** |
| Average Hog Ingestion | Cs-137 | 1.680E+00 | | 0.710 | | 0.970 | | |
| MEI Hog Ingestion | Cs-137 | 5.000E+00 | | 0.710 | | 4.290 | 4.290 | **4.29** |
| | | | | Total Radiation Detections | | | 10.980 | |
| | | | | **Total MEI Radiation Dose** | | | | **10.95** |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water at boat landings).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999. 1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.
8. Previous reported lab error for air inhalation applied only to the alpha determination hold time. U-238 dose should be included.
9. Errata: Previously reported lab error for air inhalation applied only to alpha determination hold times and not to specific radionuclides.

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## Radiological Dose Calculation Data

**Table 3. 2001 MEI Radiation Dose**

| Project | Isotope | Average Activity | Background Activity | Net Activity | Max Consump. Rate | Average Act w/ Max Consump. | Subtotal Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **mrem** |
| **Fish Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.27** |
| | H-3 | 7.800E-01 | 0.000E+00 | 0.780 | 48.2 | 0.002 | 0.267 | |
| | Cs-137 | 1.100E-01 | 0.000E+00 | 0.110 | 48.2 | 0.265 | | |
| **Milk Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.00** |
| | H-3 | 0.000E+00 | 0.000E+00 | 0.000 | 230 | 0.000 | 0.000 | |
| **DW Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | ***3** |
| PWSRW | H-3 | 5.390E+02 | 2.580E+02 | 281.000 | 730 | 0.013 | 0.013 | |
| **Rainwater** | H-3 | 3.960E+02 | 2.020E+02 | 194.000 | 730 | 0.009 | 0.009 | |
| **Air Inhalation** | | $pCi/m^3$ | $pCi/m^3$ | $pCi/m^3$ | m3/yr | mrem | mrem | **0.01** |
| | H-3 | 1.870E-01 | 4.350E+00 | -4.163 | 8000 | -0.002 | 0.005 | |
| | Alpha*1 | 2.000E-03 | 3.800E-03 | -0.002 | 8000 | -4.443 | | |
| | U-238 | 2.130E-06 | 0.000E+00 | 0.000 | 8000 | 0.002 | | |
| | Am-243 | 3.100E-06 | 0.000E+00 | 0.000 | 8000 | 0.003 | | |
| **TLD b-G** | *4 | mR/day | mR/day | mrem/yr | hrs/day | mrem | Perimeter TLD | **0.00** |
| | beta-gamma | 1.590E-01 | 1.980E-01 | 0.000 | 24 | 0.000 | 0.000 | |
| **Soil** | | pCi/g | pCi/g | pCi/g | mg/day | mrem | mrem | **0.01** |
| Ingestion | Pu-238 | 1.840E-02 | 0.000E+00 | 0.018 | 100 | 0.000 | 0.009 | |
| | Pu-239/240 | 3.840E-02 | 2.000E-02 | 0.018 | 100 | 0.000 | | |
| | | | | | hrs/yr | mrem | | |
| Direct | Pu-238 | 1.840E-02 | 0.000E+00 | 0.018 | 4380 | 0.000 | | |
| | Pu-239/240 | 3.840E-02 | 2.000E-02 | 0.018 | 4380 | 0.000 | | |
| | | | | | m3/yr | mrem | | |
| Resuspension | Pu-238 | 1.840E-02 | 0.000E+00 | 0.018 | 8000 | 0.004 | | |
| | Pu-239/240 | 3.840E-02 | 2.000E-02 | 0.018 | 8000 | 0.005 | | |
| **Surface Water** | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | mrem | |
| Swimming Ingestion & | H-3 | 9.344E+02 | 2.380E+02 | 696.400 | 91 | 0.000 | 0.033 | |
| Exposure | Alpha*1 | 5.400E-01 | 1.590E+00 | 0.000 | 91 | 0.000 | | |
| | Beta*2 | 8.830E-01 | 2.860E+00 | 0.000 | 91 | 0.000 | | |
| Boating Exposure | H-3 | 9.344E+02 | 2.380E+02 | 696.400 | 192 | 0.000 | | |
| | Alpha*1 | 5.400E-01 | 1.590E+00 | 0.000 | 192 | 0.000 | | |
| | Beta*2 | 8.830E-01 | 2.860E+00 | 0.000 | 192 | 0.000 | | |
| **Boat Landing Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | | **0.03** |
| (MEI Drinking Water) | H-3 | 9.344E+02 | 2.380E+02 | 696.400 | 730 | 0.033 | | |
| | Alpha*1 | 5.400E-01 | 1.590E+00 | 0.000 | 730 | 0.000 | | |
| | Beta*2 | 8.830E-01 | 2.860E+00 | 0.000 | 730 | 0.000 | | |
| **Sediment** | | pCi/g | pCi/g | pCi/g | hrs/yr | mrem | mrem | **0.00** |
| Shoreline | Alpha*1 | 9.150E+00 | 9.480E+00 | 0.000 | 4380 | 0.001 | 0.003 | |
| | Beta*2 | 4.830E+00 | 2.580E+01 | 0.000 | 4380 | 0.002 | | |
| **Groundwater** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | |
| Ingestion | Alpha*1 | 8.320E+00 | 4.880E+00 | 3.440 | 730 | 0.013 | 0.013 | |
| | Beta*2 | 2.080E+00 | 8.460E+00 | 0.000 | 730 | 0.000 | | |
| | | **Dose** | | **Background** | | **Net Dose** | | |
| **Game Animal** | | mrem | | mrem | | mrem | | |
| Average Deer Ingestion | Cs-137 | 1.220E+00 | | 1.140 | | 0.080 | mrem | |
| MEI Deer Ingestion | Cs-137 | 9.500E+00 | | 1.140 | | 8.360 | 8.360 | **8.36** |
| | | | | | Total Radiation Detections | | 0.000 | |
| | | | | **Total MEI Radiation Dose** | | | 8.712 | |
| | | | | | | | | **8.68** |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water at boat landings).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.

1 mR=1mrem - no identified source.

5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

**Table 4. 2002 MEI Radiation Dose**

| Project | Isotope | Average Activity | Background Activity | Net Activity | Max Consump. Rate | Average Act w/ Max Consump. | Subtotal Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **mrem** |
| **Fish Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.61** |
| Bass | H-3 | 1.040E+00 | 0.000E+00 | 1.040 | 48.2 | 0.003 | 0.606 | |
| | Cs-137 | 2.500E-01 | 0.000E+00 | 0.250 | 48.2 | 0.603 | | |
| Catfish | H-3 | 4.100E-01 | 0.000E+00 | 0.410 | 48.2 | 0.001 | | |
| | Cs-137 | 8.000E-02 | 0.000E+00 | 0.080 | 48.2 | 0.193 | | |
| Bowfin | H-3 | 2.900E-01 | 0.000E+00 | 0.290 | 48.2 | 0.001 | | |
| **Milk Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.00** |
| | H-3 | 1.230E-02 | 0.000E+00 | 0.012 | 230 | 0.000 | 0.000 | |
| **Edible Veg Ingestion** | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | mrem | **0.00** |
| | H-3 | 1.370E-01 | 3.790E-01 | 0.000 | 73 | 0.000 | 0.000 | |
| **DW Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | ***3** |
| PWSRW | H-3 | 7.060E+02 | 2.580E+02 | 448.000 | 730 | 0.021 | 0.021 | |
| **Rainwater** | H-3 | 5.910E+02 | 4.270E+02 | 164.000 | 730 | 0.008 | 0.008 | |
| **Air Inhalation** | | $pCi/m^3$ | $pCi/m^3$ | $pCi/m^3$ | m3/yr | mrem | mrem | **0.00** |
| | H-3 | 1.480E+00 | 4.350E+00 | 0.000 | 8000 | 0.000 | 0.000 | |
| | UnkAlpha*1 | 1.000E-03 | 3.800E-03 | -0.003 | 8000 | -6.911 | | |
| | UnkBeta*2 | 1.000E-03 | 2.000E-02 | 0.000 | 8000 | 0.000 | | |
| **TLD b-G** | | mrem/day | mrem/day | mrem/yr | hrs/day | mrem | mrem | **0.00** |
| | beta-gamma | 1.590E-01 | 1.980E-01 | 0.000 | 24 | 0.000 | 0.000 | |
| **Soil** | | pCi/g | pCi/g | pCi/g | mg/day | mrem | mrem | **0.00** |
| Ingestion | Sr-89 | 0.000E+00 | 0.000E+00 | 0.000 | 100 | 0.000 | 0.000 | |
| | | | | | hrs/yr | mrem | | |
| Direct | Sr-89 | 0.000E+00 | 0.000E+00 | 0.000 | 4380 | 0.000 | | |
| | | | | | m3/yr | mrem | | |
| Resuspension | Sr-89 | 0.000E+00 | 0.000E+00 | 0.000 | 8000 | 0.000 | | |
| **Surface Water** | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | mrem | |
| Swimming Ingestion & | H-3 | 8.100E+02 | 2.380E+02 | 572.000 | 91 | 0.000 | 0.053 | |
| Exposure | UnkAlpha*1 | 2.160E+00 | 1.590E+00 | 0.570 | 91 | 0.005 | | |
| | UnkBeta*2 | 0.000E+00 | 2.860E+00 | 0.000 | 91 | 0.000 | | |
| Boating Exposure | H-3 | 8.100E+02 | 2.380E+02 | 572.000 | 192 | 0.000 | | |
| | UnkAlpha*1 | 2.550E+00 | 1.590E+00 | 0.960 | 192 | 0.000 | | |
| **Boat Landing Ingestion** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | | **0.05** |
| (MEI Drinking Water) | H-3 | 8.100E+02 | 2.380E+02 | 572.000 | 730 | 0.027 | | |
| | UnkAlpha*1 | 2.160E+00 | 1.590E+00 | 0.570 | 730 | 0.022 | | |
| **Sediment** | | pCi/g | pCi/g | pCi/g | hrs/yr | mrem | mrem | **0.00** |
| Shoreline | Cs-137 | 1.225E+00 | 3.500E-02 | 1.190 | 4380 | 0.000 | 0.000 | |
| **Groundwater** | | pCi/L | pCi/L | pCi/L | L/yr | mrem | mrem | |
| Ingestion | UnkAlpha*1 | 2.450E+00 | 4.880E+00 | -2.430 | 730 | -0.092 | 0.000 | **0.00** |
| | UnkBeta*2 | 2.420E+00 | 8.460E+00 | -6.040 | 730 | -0.053 | | |
| | Ra-226 | 9.590E-01 | 4.880E+00 | -3.921 | 730 | -3.795 | | |
| | | **Dose** | | **Background** | | **Net** | | |
| **Game Animal** | | mrem | | mrem | | mrem | mrem | |
| Average Deer Ingestion | Cs-137 | 2.370E+00 | | 1.02 | | 1.350 | | |
| MEI Deer Ingestion | Cs-137 | 2.127E+01 | | 1.02 | | 20.250 | 20.250 | **20.25** |
| Average Hog Ingestion | Cs-137 | 4.640E+00 | | 1.02 | | 3.620 | | |
| MEI Hog Ingestion | Cs-137 | 1.797E+01 | | 1.02 | | 16.950 | 16.950 | **16.95** |
| | | | | | Total Radiation Detections | | 37.888 | |
| | | | | **Total MEI Radiation Dose** | | | | **37.86** |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water at boat landings).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.
1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

**Table 5. 2003 MEI Radiation Dose - Detects Only in Food Sources**

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| **Food Sources** | | **Activity** | **Activity** | **Activity** | | **mrem** | **per Radionuclide** | **Radiation Dose** | **Dose** |
| **Species** | | | | | | | | | **mrem** |
| **Fish Ingestion** | | **pCi/g** | **pCi/g** | **pCi/g** | **kg/yr** | **mrem** | **Fish mrem avg/rad** | Total mrem/species | |
| Bass | **H-3** | 9.110E-01 | 0.000E+00 | 0.911 | 48.2 | **0.003** | **tritium avg 0.002** | Bass | |
| | **Cs-137** | 1.233E-01 | 0.000E+00 | 0.123 | 48.2 | **0.297** | **Cs-137 avg 0.218** | 0.300 | |
| | | | | **Bass** | **Avg** | **0.150** | | Catfish | |
| Catfish | **H-3** | 4.460E-01 | 0.000E+00 | 0.446 | 48.2 | **0.001** | | 0.164 | |
| | **Cs-137** | 6.745E-02 | 0.000E+00 | 0.067 | 48.2 | **0.163** | | Spotted Sucker | |
| | | | | **Catfish** | **Avg** | **0.082** | Fish Total Detect Dose | 0.195 | |
| Spotted Sucker | **H-3** | 5.860E-01 | 0.000E+00 | 0.586 | 48.2 | **0.002** | 0.659 | | |
| | **Cs-137** | 8.012E-02 | 0.000E+00 | 0.080 | 48.2 | **0.193** | Fish Average Dose | | |
| | | | | **Sucker** | **Avg** | **0.097** | 0.220 | | |
| | | **Average Radionuclide Dose** | | | | | | | |
| **Milk Animals** | | | | | | | **Highest Fish Dose by Radioisotopes…** | | **0.30** |
| **Milk Ingestion** | | **pCi/g** | **pCi/g** | **pCi/g** | **kg/yr** | **mrem** | **Milk mrem avg/rad** | Goat Milk MEI Dose--- | **0.09** |
| Cow | **H-3** | 3.270E-01 | 0.000E+00 | 0.327 | 230 | **0.005** | **tritium 0.005** | Total mrem/species | |
| | **Sr-90** | 1.220E-03 | 0.000E+00 | 0.001 | 230 | **0.003** | **Cs-137 0.069** | Cow | |
| | | | | **Cow** | **Avg** | **0.004** | **Sr-89 0.014** | 0.008 | |
| Goat | | **pCi/g** | **pCi/g** | **pCi/g** | **kg/yr** | **mrem** | **Sr-90 0.003** | Goat | |
| | **H-3** | 3.010E-01 | 0.000E+00 | 0.301 | 230 | **0.004** | Milk Average Dose | 0.087 | |
| | **Cs-137** | 6.000E-03 | 0.000E+00 | 0.006 | 230 | **0.069** | 0.048 | | |
| | **Sr-89** | 6.470E-03 | 0.000E+00 | 0.006 | 230 | **0.014** | Milk Total Dose | | |
| | | | | **Goat** | **Avg** | **0.029** | 0.095 | | |
| **Game Animal** | | **Average** | | **Average Bkg** | | | | | |
| **Ingestion** | | **Dose/Animal** | | **Dose/Animal** | | | **Game Animal** | | |
| | | **mrem** | | **mrem** | | **mrem** | **mrem** | | |
| Average Deer | **Cs-137** | 1.590E+00 | | 1.38 | | **0.21** | **0.21** | | |
| MEI Deer | **Cs-137** | 6.960E+00 | | 1.38 | | **5.58** | **5.58** | 5.58 | **5.58** |
| **Edible Vegetation** | | **pCi/g** | **pCi/g** | **pCi/g** | **kg/yr** | **mrem** | **mrem** | **Edible Veg Total Dose** | |
| Vegetable Fruit | **H-3** | 4.460E-01 | 0.000E+00 | 0.446 | 287 | **0.008** | **0.008** | 0.01 | **0.01** |
| | | | | | | Total Radiation Detections | | 6.344 | |
| | | | | | | **Total MEI Food Dose** | | | **5.98** |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water at boat landings).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.
1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

Table 6. 2003 MEI Radiation Dose - Detects Only in Water Sources

| Project | Isotope | Avg Activity | Bkg Activity | Net Activity | MCR | Dose mrem | Exposure per Radionuclide | Subtotals for Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|---|
| **Water Sources** | | | | | | | **Average Dose** | **Total Dose (mrem)** | **mrem** |
| **PWS RW Ingestion** | **pCi/L** | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **DW mrem avg/rad** | River Water PWS Supply | |
| Potable | **H-3** | **5.73E+02** | 2.77E+02 | 295.500 | 730 | **0.014** | **Tritium 0.015** | 0.029 | |
| | **Alpha** | **1.60E+00** | 1.57E+00 | 0.030 | 730 | **0.001** | **Alpha 0.001** | | |
| | **Beta** | **6.08E+00** | 4.47E+00 | 1.610 | 730 | **0.014** | **Beta 0.007** | | |
| | **PWS River Water Average Dose** | | | | **Avg** | **0.010** | | | |
| **PWS GW Ingestion** | **pCi/L** | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **PWS Avg Dose** | PWS GW Wells Total | |
| Potable | **H-3** | **3.57E+02** | 4.00E+00 | 353.300 | 730 | **0.017** | 0.008 | 0.017 | |
| | **Alpha** | **4.24E+00** | 4.88E+00 | -0.640 | 730 | **0.000** | PWS Total Dose | | |
| | **Beta** | **2.03E+00** | 6.47E+00 | -4.440 | 730 | **0.000** | 0.046 | | |
| | **PWS Groundwater Average Dose** | | | | **Avg** | **0.006** | | | |
| **Used Aiken State Park C-3 wells as background.** | | | | | PWS Avg Dose | | **All GW - Tritium Ttl** | | |
| **Used tritium natural isotopic ratio as background.** | | | | | 0.023 | | 0.046 | | |
| **DNR GW Ingestion** | **pCi/L** | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **All GW - Tritium Avg** | DNRGW NORM Ttl Dose | |
| Potable | **H-3** | **3.35E+02** | 3.70E+00 | 331.300 | 730 | **0.015** | 0.016 | 1.181 | |
| | **Alpha** | **3.04E+00** | 4.88E+00 | -1.840 | 730 | **0.000** | **All GW/wellwater avg** | Is downgradient NORM | |
| | **Beta** | **3.13E+00** | 6.47E+00 | -3.340 | 730 | **0.000** | 0.135 | | |
| | **U-238** | **4.84E-01** | 2.17E-01 | 0.267 | 730 | **0.005** | **All GW/wellwater ttl** | DNR nonNORM Dose | |
| | **Ra-226** | **1.13E+00** | 0.00E+00 | 1.132 | 730 | **1.096** | 1.213 | 0.015 | |
| | **Ra-228** | **1.87E+00** | 1.79E+00 | 0.077 | 730 | **0.080** | Avg Potable & NORM | | |
| | **DNR Wells Average Dose** | | | | **Avg** | **0.199** | 0.414 | | |
| | **PWSGW & DNRGW Media Average Dose** | | | | **Avg** | **0.102** | Total Potable & NORM | | |
| **Potable Water Dose (PWS&DNR Media) Average** | | | | | | **0.072** | 1.242 | | |
| **Water Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **Nonpotable** | | |
| SR Boat | **H-3** | 1.72E+03 | 3.13E+02 | 1405.000 | 730 | **0.066** | **Average Dose** | | |
| Landings | **Alpha** | 1.66E+00 | 1.63E+00 | 0.034 | 730 | **0.001** | **0.018** | | |
| Nonpotable | **Beta** | 2.55E+00 | 2.33E+00 | 0.218 | 730 | **0.002** | | | |
| Rainwater | **H-3** | 2.73E+02 | 1.97E+02 | 76.000 | 730 | **0.004** | | 0.004 | |
| **Nonpotable Surface Water Average Dose** | | | | | **Avg** | **0.018** | | Nonpotable Ttl. MEI Dose | |
| **Nonpotable Surface Water Total Dose** | | | | | **Ttl** | **0.072** | | 0.072 | |
| | | | | | | | **MEI Drinking Water Dose (Highest)** | | **0.07** |
| **Cannot add doses from more than one DW source unless consumption rate of each is modified.** | | | | | | | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | Swimming Ingestion | **0.00** |
| Ingestion | **H-3** | 1.72E+03 | 3.13E+02 | 1405.000 | 91 | **0.0008** | | 0.001 | |
| hile swimmi | **Alpha** | 1.66E+00 | 1.63E+00 | 0.030 | 91 | **0.0000** | | | |
| | **Beta** | 2.56E+00 | 2.33E+00 | 0.000 | 91 | **0.0000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | Swimming Immersion | **0.00** |
| Immersion | **H-3** | 1.72E+03 | 3.13E+02 | 1405.000 | 91 | **0.0000** | **No H-3 exposure DF** | 0.000 | |
| Exposure | **Alpha** | 1.66E+00 | 1.63E+00 | 0.030 | 91 | **0.0000** | | | |
| | **Beta** | 2.56E+00 | 2.33E+00 | 0.000 | 91 | **0.0000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | Houseboat Exposure | **0.00** |
| Boating | **H-3** | 1.72E+03 | 3.13E+02 | 1405.000 | 192 | **0.0000** | **No H-3 exposure DF** | 0.000 | |
| Exposure | **Alpha** | 1.66E+00 | 1.63E+00 | 0.030 | 192 | **0.0000** | | | |
| | **Beta** | 2.56E+00 | 2.33E+00 | 0.000 | 192 | **0.0000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | Swamp House Exposure | **0.00** |
| wamp Dwell | **H-3** | 1.72E+03 | 3.13E+02 | 1405.000 | 4380 | **0.0000** | **No H-3 exposure DF** | 0.000 | |
| Exposure | **Alpha** | 1.66E+00 | 1.63E+00 | 0.030 | 4380 | **0.0000** | | | |
| | **Beta** | 2.56E+00 | 2.33E+00 | 0.000 | 4380 | **0.0000** | | | |
| | | | | | | | Total Radiation Detections | 1.319 | |
| | | | | | | | | **Total MEI Water Dose** | **0.07** |
| | | | | | | | | **NORM Dose** | **1.18** |
| | | | | | | | | **MEI + NORM Water Dose** | **1.25** |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha and beta dose calculated as Pu-239 and Sr-90, respectively.
2. Rainwater cistern dose is based on air station monitoring of rainwater collected locally outside of SRS.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water at boat landings).
4. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
5. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.
6. DNR wells make up most of the ambient groundwater monitoring project (AGMP) or network (AGMN).
7. Savannah River boat landings (Steel Creek Landing, Little Hell Landing, and Brunson's Ferry) are subject to the use of boiled water by sportsmen

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## Radiological Dose Calculation Data

Table 7. 2003 MEI Radiation Dose - Detects Only For Soil, and Air

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Radiation Dose | Dose |
| **Surface Soil Ingestion** | | **pCi/g** | **pCi/g** | **pCi/g** | **mg/day** | **mrem** | **Total Soil Ingestion** | | **0.00** |
| Th-232 series | **Pb-212** | **6.01E-01** | 5.84E-01 | 0.017 | 100 | **0.000** | Gamma Avg 0.0001 | | |
| | **Mn-54** | **1.60E-02** | 0.00E+00 | 0.016 | 100 | **0.000** | Gamma Total 0.0005 | nonNORM Dose | |
| | **Cs-137** | **1.80E-01** | 1.74E-01 | 0.006 | 100 | **0.000** | | 0.0010 | |
| | **Ce-144** | **2.65E-01** | 0.00E+00 | 0.265 | 100 | **0.000** | Beta Avg 0.0003 | | |
| Sediment | **Cs-137** | **3.07E-01** | 2.94E-02 | 0.278 | 100 | **0.001** | Beta Total 0.0003 | **NORM Dose** | |
| | **Tc-99** | **5.16E+00** | 0.00E+00 | 5.160 | 100 | **0.000** | | 0.0000 | |
| | **Surface Soil Ingestion Average Dose** | | | | **Avg** | **0.000** | | | |
| **Surface Soil Exposure** | | **pCi/g** | **pCi/g** | **pCi/g** | **hrs/yr** | **mrem** | **Total Soil Direct Exposure** | | **0.02** |
| Direct Exposure | **Pb-212** | **6.01E-01** | 5.84E-01 | 0.017 | 4380 | **0.002** | Gamma Avg 0.0034 | | |
| | **Mn-54** | **1.60E-02** | 0.00E+00 | 0.016 | 4380 | **0.014** | Gamma Total 0.0169 | nonNORM Dose | |
| | **Cs-137** | **1.80E-01** | 1.74E-01 | 0.006 | 4380 | **0.000** | Beta Avg 0.0002 | 0.0186 | |
| | **Ce-144** | **2.65E-01** | 0.00E+00 | 0.265 | 4380 | **0.004** | Beta Total 0.00 | | |
| Sediment | **Cs-137** | **3.07E-01** | 2.94E-02 | 0.278 | 4380 | **0.000** | NORM Avg Dose 0.002 | **NORM Total Dose** | |
| | **Tc-99** | **5.16E+00** | 0.00E+00 | 5.160 | 4380 | **0.000** | | 0.002 | |
| Shoreline | Direct Ground Exposure Average Dose - All Rads | | | | | 0.004 | | | |
| **TLD** | | **mrem** | **mrem** | **mrem** | **hrs/day** | **mrem** | | Ttl Absorbed Dose | **0.00** |
| Direct Exposure | **Direct** | 8.42E+01 | 8.46E+01 | -0.400 | 24.0 | **0.000** | **Offsite** | 0.000 | |
| **Surface Soil Resuspension** | | **pCi/g** | **pCi/g** | **pCi/g** | **m3/yr** | **mrem** | **Total Soil Resuspension** | | **0.00** |
| and inhalation | **Pb-212** | **6.01E-01** | 5.84E-01 | 0.017 | 8000 | **0.000** | Gamma Avg 0.00 | | |
| | **Mn-54** | **1.60E-02** | 0.00E+00 | 0.016 | 8000 | **0.000** | Gamma Total 0.00 | | |
| | **Cs-137** | **1.80E-01** | 1.74E-01 | 0.006 | 8000 | **0.000** | Beta Avg 0.00 | nonNORM Dose | |
| | **Ce-144** | **2.65E-01** | 0.00E+00 | 0.265 | 8000 | **0.000** | Beta Total 0.00 | 0.000 | |
| Sediment | **Cs-137** | **3.07E-01** | 2.94E-02 | 0.278 | 8000 | **0.000** | NORM Avg 0.00 | | |
| | **Tc-99** | **5.16E+00** | 0.00E+00 | 5.160 | 8000 | **0.000** | | **NORM Total Dose** | |
| | Surface Soil Direct Ground Exposure Average Dos | | | | All rads | 0.000 | | 0.000 | |
| **Air Inhalation** | | **pCi/m3** | **pCi/m3** | **pCi/m3** | **m3/yr** | **mrem** | **Total Inhalation (LE)** | | **0.01** |
| Inhalation | **H-3** | **5.71E+00** | 3.98E+00 | 1.733 | 8000 | **0.001** | | | |
| | **Alpha** | **4.00E-03** | 3.90E-03 | 0.000 | 8000 | **0.370** | **LE** | nonNORM Dose | |
| | **Beta** | **2.02E-02** | 1.91E-02 | 0.001 | 8000 | **0.011** | | 0.012 | |
| | | | | | **Avg** | **0.128** | | | |
| | | | | | | | Total Radiation Detections | 0.034 | |
| | | | | | | | | **MEI Dose** | **0.03** |
| | | | | | | | | NORM Total Dose | 0.00 |
| | | | | | | | | **MEI Air + Soil Dose** | **0.03** |

Notes: see the acronym section for abbreviations.

1. The NORM samples greater than background occurred in flood plain areas downstream from saprolitic granite.
2. A lab error in the gross alpha determination took place due to delayed analysis time.
3. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
4. TLD dose was re-evaluated in 2006 using only locations with a full year of detected data and subtracted outer perimeter from inner perimeter locati
5. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

Table 8. 2004 MEI Radiation Dose - Detects Only in Food Sources

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Radiation Dose | Dose |
| Food Sources | | | | | | | Average Dose | Total mrem/species | mrem |
| Fish Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Fish mrem avg/rad | Bass | |
| Bass | H-3 | 1.90E+00 | 0.00E+00 | 1.897 | 48.2 | 0.006 | H-3 avg dose | 0.435 | |
| | Cs-137 | 1.78E-01 | 0.00E+00 | 0.178 | 48.2 | 0.429 | 0.004 | Catfish | |
| | | | | Bass | Avg | 0.217 | Cs-137 avg dose | 0.403 | |
| Catfish | H-3 | 1.04E+00 | 0.00E+00 | 1.043 | 48.2 | 0.003 | 0.415 | Shad | |
| | Cs-137 | 1.66E-01 | 0.00E+00 | 0.166 | 48.2 | 0.400 | | 0.001 | |
| | | | | Catfish | Avg | 0.202 | Fish Average Dose | Mullett | |
| Shad | H-3 | 2.85E-01 | 0.00E+00 | 0.285 | 48.2 | 0.001 | 0.211 | 0.004 | |
| Mullett | H-3 | 1.45E+00 | 0.00E+00 | 1.450 | 48.2 | 0.004 | Fish Total Dose | | |
| | | | | Sucker | Avg | 0.003 | 0.843 | | |
| | | | | | | | Highest Total Fish Dose by Radioisotopes | | 0.44 |
| Milk Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Milk mrem avg/rad | Milk Maximum Dose--- | 0.18 |
| Cow | H-3 | 0.00E+00 | 0.00E+00 | 0.000 | 230 | 0.000 | H-3 or tritium | by Radioisotope Maximums | |
| | Sr-90 | 2.00E-03 | 1.51E-03 | 0.000 | 230 | 0.006 | 0.000 | | |
| | Cs-137 | 4.16E-03 | 3.77E-03 | 0.000 | 230 | 0.001 | Cs-137 avg dose | | |
| milk solids | Sr-89 | 1.41E-01 | 6.12E-02 | 0.080 | 230 | 0.169 | 0.001 | | |
| Goat | Sr-90 | 2.96E-03 | 2.70E-03 | 0.000 | 230 | 0.003 | Sr-89 avg dose | | |
| | | | Milk avg dose | | | 0.036 | 0.169 | | |
| Cow Milk total dose | | | Cow Milk avg dose | | | 0.002 | Highest Total Milk Dose by Radioisotopes | | |
| | 0.007 | | | | Avg | 0.014 | | 0.176 | |
| | | Average Radionuclide Dose | | | | | | | |
| Game Animal | | Average | | Average Bkg | | | | | |
| Ingestion | | Dose/Animal | | Dose/Animal | | | Game Animal | | |
| | | mrem | | mrem | | mrem | mrem | | |
| Average Deer | Cs-137 | 1.89E+00 | | 1.05 | | 0.84 | 0.84 | | |
| MEI Deer | Cs-137 | 1.68E+01 | | 1.05 | | 15.74 | 15.74 | 15.74 | 15.74 |
| Edible Vegetation | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Veg Avg Dose | Edible Veg Total Dose | |
| Vegetable Frui | H-3 | 5.97E-01 | 0.00E+00 | 0.597 | 287.0 | 0.011 | 0.011 | 0.011 | 0.01 |
| | | | | | | Total Radiation Detections | | 16.770 | |
| | | | | | | | | Total MEI Food Dose | 16.37 |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
5. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
6. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

**Table 9. 2004 MEI Radiation Dose - Detects Only in Water Sources**

| Project | Isotope | Avg Activity | Bkg Activity | Net Activity | MCR | Dose mrem | Exposure per Radionuclide | Subtotals for Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|---|
| **Water Sources** | | | | | | | **Average Dose** | **Total Dose (mrem)** | **mrem** |
| **PWS RW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **DW mrem avg/rad** | **River Water PWS Supply** | |
| Potable | **H-3** | **4.90E+02** | 2.45E+02 | 244.500 | 730 | **0.011** | **Tritium 0.013** | 0.012 | |
| | **Alpha*1** | **2.97E+00** | 0.00E+00 | 0.030 | 730 | **0.001** | **Alpha 0.021** | | |
| | | | | | | | **Beta 0.019** | | |
| | **PWS River Water Average Dose** | | | | **Avg** | **0.006** | | | |
| **PWS GW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **PWS Avg 0.033** | **Groundwater PWS Wells** | |
| Potable | **H-3** | **3.00E+02** | 4.00E+00 | 295.600 | 730 | **0.014** | **PWS Total 0.066** | 0.054 | |
| | **Alpha*1** | **3.72E+00** | 2.66E+00 | 1.061 | 730 | **0.040** | **All GW - Tritium Ttl** | | |
| **SC Alpha background-average of 128 well samples in 2004.** | | | | | | | 0.025 | | |
| | **PWS Well Water Average Dose** | | | | **Avg** | **0.027** | **All GW - Tritium Avg** | | |
| | **Used Aiken State Park C-3 wells as background.** | | | | | | 0.013 | | |
| | **Used tritium natural isotopic ratio as background.** | | | | | | | | |
| **DNR GW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **All GW/wellwater avg** | **DNRGW Ttl Dose** | |
| Potable | **Alpha*1** | **1.30E+00** | 6.00E-01 | 0.703 | 730 | **0.027** | 0.025 | 0.046 | |
| | **Beta*2** | **3.88E+00** | 1.70E+00 | 2.180 | 730 | **0.019** | **All GW/wellwater ttl** | | |
| **Beta background is average of 3 wells upgradient of SRS.** | | | | | | | 0.100 | | |
| | **DNR Wells Average Dose** | | | | **Avg** | **0.023** | | | |
| GW & DNR | **Groundwater Average Dose** | | | | **Avg** | **0.025** | | | |
| **Potable Water Dose Average** | | | | | | **0.019** | | | |
| **Water Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | | | |
| SR Boat | **H-3** | 8.38E+02 | 2.01E+02 | 637.000 | 730 | **0.030** | | | |
| Landings | **Alpha*1** | 1.56E+00 | 2.12E+00 | 0.000 | 730 | **0.000** | | **Nonpotable Ttl. MEI Dose** | |
| Nonpotable | **Beta*2** | 3.17E+00 | 5.30E+00 | 0.000 | 730 | **0.000** | | 0.044 | |
| Rainwater | **H-3** | 2.93E+02 | 0.00E+00 | 293.300 | 730 | **0.014** | | | |
| **Nonpotable Surface Water Average Dose** | | | | | **Avg** | **0.011** | | | |
| | | | | | | | **MEI Drinking Water Dose (Highest)** | | **0.05** |
| **Cannot add doses from more than one DW source unless consumption rate of each is modified.** | | | | | | | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swimming Ingestion** | |
| Ingestion | **H-3** | 8.83E+02 | 2.44E+02 | 639.000 | 91 | **0.000** | | 0.000 | **0.00** |
| while swimming | **Alpha*1** | 1.76E+00 | 2.12E+00 | -0.365 | 91 | **0.000** | | | |
| | **Beta*2** | 3.25E+00 | 5.30E+00 | -2.049 | 91 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swimming Immersion** | |
| Immersion | **H-3** | 8.83E+02 | 2.44E+02 | 639.000 | 91 | **0.000** | **No H-3 exposure DF** | 0.000 | **0.00** |
| Exposure | **Alpha*1** | 1.88E+00 | 2.12E+00 | -0.245 | 91 | **0.000** | | | |
| | **Beta*2** | 3.25E+00 | 5.30E+00 | -2.049 | 91 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Houseboat Exposure** | |
| Boating | **H-3** | 8.83E+02 | 2.44E+02 | 639.000 | 192 | **0.000** | **No H-3 exposure DF** | 0.000 | **0.00** |
| Exposure | **Alpha*1** | 1.88E+00 | 2.12E+00 | -0.245 | 192 | **0.000** | | | |
| | **Beta*2** | 3.25E+00 | 5.30E+00 | -2.049 | 192 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swamp House Exposure** | |
| Swamp Dweller | **H-3** | 8.83E+02 | 2.44E+02 | 639.000 | 4380 | **0.000** | **No H-3 exposure DF** | 0.000 | **0.00** |
| Exposure | **Alpha*1** | 1.88E+00 | 2.12E+00 | -0.245 | 4380 | **0.000** | | | |
| | **Beta*2** | 3.25E+00 | 5.30E+00 | -2.049 | 4380 | **-0.001** | | | |
| | | | | | | | Total Radiation Detections | 0.156 | |
| | | | | | | | | **Total MEI Water Dose** | **0.05** |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.

1 mR=1mrem - no identified source.

5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.
8. DNR wells make up most of the ambient groundwater monitoring project (AGMP) or network (AGMN).
9. Rainwater cistern dose is based on air station monitoring of rainwater collected locally outside of SRS.
10. Savannah River boat landings (Steel Creek Landing, Little Hell Landing, and Brunson's Ferry) are subject to the use of boiled water by sportsmen

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# Radiological Dose Calculation Data

Table 10. 2004 MEI Radiation Dose - Detects Only For Soil, Air, and Surface Water

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Radiation Dose | Dose |
| **Surface Soil Ingestion** | | pCi/g | pCi/g | pCi/g | mg/day | mrem | **Total Soil Ingestion Dose** | | **0.02** |
| Th-232 series | Pb-212 | **8.10E-01** | 5.50E-01 | 0.260 | 100 | **0.000** | **Gamma Avg 0.001** | | |
| U-238 series | Pb-214 | **9.40E-01** | 7.60E-01 | 0.180 | 100 | **0.000** | **Gamma Total 0.005** | | |
| Th-232 series | Ac-228 | **1.15E+00** | 1.05E+00 | 0.100 | 100 | **0.000** | **Alpha Avg 0.006** | | |
| U-238 series | Ra-226 | **1.93E+00** | 1.85E+00 | 0.080 | 100 | **0.004** | **Alpha Total 0.022** | | |
| Alpha | U-234*1 | **1.99E+00** | 6.02E-01 | 1.386 | 100 | **0.001** | | | |
| Alpha | U-238 | **3.84E-01** | 3.30E-01 | 0.053 | 100 | **0.000** | **Avg NORM dose 0.001** | **Ttl NORM dose…..** | |
| Sediment | **Cs-137** | **2.00E-01** | 0.00E+00 | 0.200 | 100 | **0.000** | | 0.006 | |
| Alpha | **as Pu-239** | **1.95E+01** | 1.03E+01 | 9.200 | 100 | **0.017** | | **Total nonNORM Dose** | |
| | **Surface Soil Ingestion Average Dose** | | | | Avg | **0.003** | | 0.018 | |
| **Surface Soil Exposure** | | pCi/g | pCi/g | pCi/g | hrs/yr | mrem | **Total Surface Direct Exposure Dose** | | **0.00** |
| Th-232 series | Pb-212 | **8.10E-01** | 5.50E-01 | 0.260 | 4380 | **0.035** | **Gamma Avg 0.038** | | |
| U-238 series | Pb-214 | **9.40E-01** | 7.60E-01 | 0.180 | 4380 | **0.046** | **Gamma Total 0.192** | | |
| Th-232 series | Ac-228 | **1.15E+00** | 1.05E+00 | 0.100 | 4380 | **0.109** | **Alpha Avg 0.000** | | |
| U-238 series | Ra-226 | **1.93E+00** | 1.85E+00 | 0.080 | 4380 | **0.000** | **Alpha Total 0.001** | | |
| Alpha | U-234 | **1.99E+00** | 6.02E-01 | 1.386 | 4380 | **0.000** | | | |
| Alpha | U-238 | **3.84E-01** | 3.30E-01 | 0.053 | 4380 | **0.000** | **Avg NORM 0.032** | **Ttl NORM dose…..** | |
| Sediment | **Cs-137** | **2.00E-01** | 0.00E+00 | 0.200 | 4380 | **0.001** | | 0.191 | |
| Alpha | **as Pu-239** | **1.95E+01** | 1.03E+01 | 9.200 | 4380 | **0.001** | | **Total nonNORM Dose** | |
| | **Direct Ground Exposure Average Dose** | | | | Avg | **0.024** | | 0.002 | |
| **Surface Soil Resuspension** | | pCi/g | pCi/g | pCi/g | m3/yr | mrem | **Total Soil Resuspension Dose** | | **0.00** |
| Th-232 series | Pb-212 | **8.10E-01** | 5.50E-01 | 0.129 | 8000 | **0.000** | **Gamma Avg 0.000** | | |
| U-238 series | Pb-214 | **9.40E-01** | 7.60E-01 | 0.104 | 8000 | **0.000** | **Gamma Total 0.001** | | |
| Th-232 series | Ac-228 | **1.15E+00** | 1.05E+00 | 0.014 | 8000 | **0.000** | **Alpha Avg 0.808** | | |
| U-238 series | Ra-226 | **1.93E+00** | 1.85E+00 | 0.080 | 8000 | **0.001** | **Alpha Total 2.423** | | |
| Alpha | U-234 | **1.99E+00** | 6.02E-01 | 1.386 | 8000 | **0.147** | **nonNORM Total** | 0.000 | |
| Alpha | U-238 | **3.84E-01** | 3.30E-01 | 0.053 | 8000 | **0.005** | | | |
| Sediment | **Cs-137** | **2.00E-01** | 0.00E+00 | 0.200 | 8000 | **0.000** | | | |
| Alpha*2 | **as Pu-239** | **1.95E+01** | 1.03E+01 | 9.200 | 8000 | **2.271** | **Avg NORM dose** | | |
| Potential soil resuspension Dose was not detected by air filters, thus probable NORM. | | | | | | | 0.025 | **Ttl NORM dose** | |
| | **Soil Resuspension Exposure Avg Dose** | | | | Avg | **0.022** | | 2.423 | |
| **Air Inhalation** | | pCi/m3 | pCi/m3 | pCi/m3 | m3/yr | mrem | | **Total Air Inhalation** | **0.00** |
| Inhalation | **H-3** | **6.06E+00** | 3.08E+00 | 2.975 | 8000 | **0.002** | | | |
| | **Alpha** | **3.00E-03** | 3.00E-03 | 0.000 | 8000 | **0.000** | | | |
| | **Beta** | **2.28E-02** | 2.30E-02 | 0.000 | 8000 | **-0.002** | | | |
| Air Inhalation Average Dose | | | | | Avg | **0.000** | | | |
| **TLD** | | mrem | mrem | mrem | hrs/day | mrem | | | |
| Direct Exposure | **Direct** | 9.52E+01 | 9.32E+01 | 1.970 | 24.0 | **1.970** | **Offsite** | **Ttl Absorbed Dose** | **1.97** |
| No reduction factors or source assumptions assigned for unknown beta-gamma. | | | | | | | **Soil and Air subtotals** | 2.620 | |
| 1 mR=1mrem - no identified source. | | | | | | **Totals** | | **MEI Dose** | **1.99** |
| Notes: see the acronym section for abbreviations. | | | | | | | | **NORM Total Dose** | **2.62** |
| 1. The NORM samples greater than background occurred in flood plain areas downstream from saprolitic granite. | | | | | | | | **Total NORM and MEI** | **4.61** |

2. A lab error in the gross alpha determination took place due to delayed analysis time.
3. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
4. TLD dose was re-evaluated in 2006 using only locations with a full year of detected data and subtracted outer perimeter from inner perimeter locations.
5. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

Table 11. 2005 MEI Radiation Dose - Detects Only in Food Sources

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Radiation Dose | Dose |
| | | Food Sources | | | | | Average Dose | Total mrem/species | |
| Fish Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Fish mrem avg/rad | Bass | |
| Bass | H-3 | 1.02E+00 | 0.00E+00 | 1.017 | 48.2 | 0.003 | H-3 avg dose | 0.622 | |
| | Cs-137 | 2.01E-01 | 0.00E+00 | 0.201 | 48.2 | 0.484 | 0.003 | Catfish | |
| | Sr-89/90 | 3.60E-01 | 1.27E-01 | 0.233 | 48.2 | 0.134 | | 0.341 | |
| | | | | Bass | Avg | 0.207 | | Sunfish | |
| Catfish | H-3 | 4.57E-01 | 0.00E+00 | 0.457 | 48.2 | 0.001 | Cs-137 avg dose | 0.366 | |
| | Cs-137 | 1.41E-01 | 0.00E+00 | 0.141 | 48.2 | 0.340 | 0.363 | | |
| | Sr-89/90 | 2.66E-01 | 4.26E-01 | -0.160 | 48.2 | 0.000 | | | |
| | | | | Catfish | Avg | 0.114 | Sr-89/90 avg dose | | |
| Sunfish | H-3 | 1.20E+00 | 0.00E+00 | 1.200 | 48.2 | 0.004 | 0.077 | | |
| | Cs-137 | 1.10E-01 | 0.00E+00 | 0.110 | 48.2 | 0.265 | All Fish Avg 0.443 | | |
| | Sr-89/90 | 2.55E-01 | 8.70E-02 | 0.168 | 48.2 | 0.097 | All Fish Total 1.329 | | |
| | | | | Sunfish | Avg | 0.122 | MEI Fish Avg Radioisotope Dose | | |
| | | | | | | | 0.148 | Highest Dose/Rad Ttl | 0.62 |
| Milk Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Milk mrem avg/rad | Milk Maximum Dose--- | 0.00 |
| Cow | H-3 | 0.00E+00 | 0.00E+00 | 0.000 | 230 | 0.000 | H-3 or tritium | Cow Milk avg dose | |
| | Sr-90 | 4.66E-04 | 4.64E-04 | 0.000 | 230 | 0.000 | 0.000 | 0.000 | |
| | Sr-89 | 8.26E-04 | 0.00E+00 | 0.001 | 230 | 0.002 | Cs-137 avg dose | Cow Milk total dose | |
| | Cs-137 | 0.00E+00 | 0.00E+00 | 0.000 | 230 | 0.000 | 0.000 | 0.002 | |
| | | | | Cow Milk | Avg | 0.002 | Sr-89 avg dose | | |
| | | | | | | | 0.002 | | |
| | | | | | Avg | 0.001 | SR-90 avg dose | | |
| | | Average Radionuclide Dose | | | | | 0.000 | | |
| | | Average | | Average Bkg | | | | | |
| Game Animal | | Dose/Animal | | Dose/Animal | | | Game Animal | | |
| Ingestion | | mrem | | mrem | | mrem | mrem | | |
| Average Deer | Cs-137 | 1.01E+00 | | 1.110 | | -0.100 | 0.00 | | |
| | | Maximally Exposed Individual Hunter | | | | | | | |
| MEI Deer | Cs-137 | 8.75E+00 | | 1.11 | | 7.64 | 7.64 | 7.64 | 7.64 |
| | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | | | |
| Edible Veg (leafy) | H-3 | 2.07E-01 | 2.53E-04 | 0.207 | 73 | 0.001 | Veg Avg Dose | Edible Veg Total Dose | |
| Edible Veg (fruits | H-3 | 3.07E-01 | 2.53E-01 | 0.054 | 276 | 0.001 | 0.001 | 0.002 | 0.00 |
| | | | | | | Total Radiation Detections | | 8.973 | |
| | | | | | | | | Total MEI Food Dose | 8.26 |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
5. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
6. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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# Radiological Dose Calculation Data

**Table 12. 2005 MEI Radiation Dose - Detects Only in Water Sources**

| Project | Isotope | Avg Activity | Bkg Activity | Net Activity | MCR | Dose mrem | Exposure per Radionuclide | Subtotals for Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|---|
| **Water Sources** | | | | | | | **Average Dose** | | |
| **PWS RW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **Tritium avg 0.001** | **Dose (mrem)** | |
| Potable | **H-3** | **4.13E+02** | **3.74E+02** | **39.000** | 730 | **0.002** | **Alpha avg 0.047** | | |
| | **Unk Alpha** | **1.48E+00** | **0.00E+00** | **1.475** | 730 | **0.056** | **Beta avg 0.001** | | |
| | **Unk Beta** | **3.30E+00** | **3.19E+00** | **0.118** | 730 | **0.001** | | | |
| | **PWS River Water Average Dose** | | | | **Avg** | **0.020** | **Ttl PWSRW 0.059** | | |
| **PWS GW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | | | |
| Potable | **H-3** | **2.31E+02** | **2.78E+02** | 0.000 | 730 | 0.000 | **Ttl PWSGW 0.040** | | |
| | **Unk Alpha** | **5.91E+00** | **4.88E+00** | **1.030** | 730 | **0.039** | **PWS Total Dose 0.099** | | |
| | **Unk Beta** | **3.53E+00** | **3.38E+00** | **0.150** | 730 | **0.001** | **PWS Avg Dose 0.017** | | |
| | **PWS Ground Water Average Dose** | | | | **Avg** | **0.013** | | | |
| **DNR GW Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **DNR nonNORM** | | |
| Potable | **Unk Alpha** | **4.51E+00** | **4.88E+00** | 0.000 | 730 | 0.000 | **0.010** | | |
| | **Unk Beta** | **4.43E+00** | **3.38E+00** | **1.041** | 730 | **0.009** | | | |
| | **H-3** | **2.78E+02** | **2.78E+02** | **0.40** | 730 | 0.00 | | | |
| U238 series | **Ttl U** | **1.20E-01** | **2.61E-01** | 0.00 | 730 | 0.00 | | **NORM** | |
| U238 series | **Ra-226** | **1.99E+00** | **5.51E-01** | **1.44** | 730 | **1.39** | | **1.399** | |
| Th232 series | **Ra-228** | **1.19E+00** | **1.45E+00** | 0.00 | 730 | 0.00 | | | |
| Used DNR well G02259 (outside of GW study area) as Ttl U, Ra-226, Ra-228 backgrounds. | | | | | | | | | |
| | **Potable Water (PWS) Dose Average** | | | | | **0.016** | | | |
| **Nonpotable Water Ingestion** | | **pCi/L** | **pCi/L** | **pCi/L** | **L/yr** | **mrem** | **Nonpotable** | | |
| SR Boat | **H-3** | 1.15E+03 | 2.70E+02 | 881.000 | 730 | **0.041** | | | |
| Landings | **Unk Alpha** | 1.98E+00 | 3.14E+00 | -1.160 | 730 | **0.000** | | **Nonpotable Ttl. Dose** | |
| | **Unk Beta** | 2.42E+00 | 3.14E+00 | -0.720 | 730 | **0.000** | | **0.056** | |
| Rainwater | **H-3** | 3.23E+02 | 0.00E+00 | 323.000 | 730 | **0.015** | **......Cistern dose** | | |
| **Nonpotable Surface Water Average Dose** | | | | | **Avg** | **0.014** | | | |
| | Boat landing tritium, alpha, and beta backgrounds are from Jackson's Landing | | | | | | **MEI Drinking Water Dose (Highest)** | | **0.06** |
| **Cannot total doses from more than one DW source unless consumption rate of each is modified.** | | | | | | | | | |
| **Total Surface Water MEI** | | | | | | | | | **0.00** |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swimming Ingestion** | |
| Ingestion | **H-3** | **1.15E+03** | **2.70E+02** | **881.00** | 91 | **0.001** | | **0.001** | |
| while swimming | **Alpha** | **1.98E+00** | **3.14E+00** | **0.00** | 91 | **0.000** | | | |
| | **Beta** | **2.42E+00** | **3.14E+00** | **0.00** | 91 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swimming Immersion** | |
| Immersion | **H-3** | **1.15E+03** | **2.70E+02** | **881.00** | 91 | **0.000** | **No H-3 exposure DF** | **0.000** | |
| Exposure | **Alpha** | **1.98E+00** | **3.14E+00** | **0.00** | 91 | **0.000** | | | |
| | **Beta** | **2.42E+00** | **3.14E+00** | **0.00** | 91 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Houseboat Exposure** | |
| Boating | **H-3** | **1.15E+03** | **2.70E+02** | **881.00** | 192 | **0.000** | **No H-3 exposure DF** | **0.000** | |
| Exposure | **Alpha** | **1.98E+00** | **3.14E+00** | **0.00** | 192 | **0.000** | | | |
| | **Beta** | **2.42E+00** | **3.14E+00** | **0.00** | 192 | **0.000** | | | |
| **Surface Water** | | **pCi/L** | **pCi/L** | **pCi/L** | **hrs/yr** | **mrem** | | **Swamp House Exposure** | |
| Swamp Dweller | **H-3** | **1.15E+03** | **2.70E+02** | **881.00** | 4380 | **0.000** | **No H-3 exposure DF** | **0.000** | |
| Exposure | **Alpha** | **1.98E+00** | **3.14E+00** | **0.00** | 4380 | **0.000** | | | |
| | **Beta** | **2.42E+00** | **3.14E+00** | **0.00** | 4380 | **0.000** | **Total Detected Dose** | 1.456 | |

| | |
|---|---|
| **MEI DW Highest Dose** | **0.06** |
| **NORM** | **1.40** |
| **Total Dose** | **1.46** |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.
1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.
8. DNR wells make up most of the ambient groundwater monitoring project (AGMP) or network (AGMN).
9. Rainwater cistern dose is based on air station monitoring of rainwater collected locally outside of SRS.
10. Savannah River boat landings (Steel Creek Landing, Little Hell Landing, and Brunson's Ferry) are subject to the use of boiled water by sportsmen.

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# Radiological Dose Calculation Data

**Table 13. 2005 MEI Radiation Dose - Detects Only For Soil and Air**

| Project | Isotope | Avg Activity | Bkg Activity | Net Activity | MCR | Dose mrem | Exposure per Radionuclide | Subtotals for Radiation Dose | MEI Dose |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Soil & Sediment | | | | | mrem |
| **Surface Soil Ingestion** | | **pCi/g** | **pCi/g** | **pCi/g** | **mg/day** | **mrem** | **Total Soil Ingestion Dose** | | **0.02** |
| Th-232 series | Pb-212 | **1.18E+00** | **1.41E+00** | 0.000 | 100 | 0.000 | **Gamma Avg Dose** | **nonNORM Dose** | |
| U-238 series | Pb-214 | **1.06E+00** | **6.85E-01** | **0.377** | 100 | 0.000 | 0.005 | 0.016 | |
| Th-232 series | Ac-228 | **1.11E+00** | **9.82E-01** | **0.129** | 100 | 0.000 | **Gamma Total Dose** | | |
| U-238 series | Ra-226 | **2.30E+00** | **1.63E+00** | **0.663** | 100 | **0.032** | 0.034 | | |
| alpha | U-234 | **1.91E-01** | **2.92E-01** | 0.000 | 100 | 0.000 | **Alpha Total Dose** | | |
| alpha | U-235[1] | **6.96E-02** | 0.00E+00 | **0.070** | 100 | 0.000 | 0.015 | | |
| alpha | U-238 | **1.94E-01** | **3.26E-01** | 0.000 | 100 | 0.000 | **Alpha Avg Dose** | | |
| | **Eu-155** | **5.53E-01** | **3.75E-01** | **0.178** | 100 | 0.000 | 0.004 | | |
| Soil | **Cs-137** | **2.02E-01** | **1.66E-01** | **0.036** | 100 | 0.000 | | | |
| Sediment | **Cs-137** | **7.30E-01** | **0.00E+00** | **0.730** | 100 | **0.001** | Avg NORM 0.005 | Ttl NORM dose | |
| Unknown Alpha | **as Pu-239** | **1.54E+01** | **7.65E+00** | **7.735** | 100 | **0.015** | | 0.032 | |
| See note* | **Soil Ingestion Average Dose** | | | | **Avg** | 0.004 | | | |
| **Surface Soil Exposure** | | **pCi/g** | **pCi/g** | **pCi/g** | **hrs/yr** | **mrem** | **Total Direct nonNORM Exposure Dose** | | **2.21** |
| Th-232 series | Pb-212 | **1.18E+00** | **1.41E+00** | 0.000 | 4380 | 0.000 | **Gamma Avg Dose** | | |
| U-238 series | Pb-214 | **1.06E+00** | **6.85E-01** | **0.377** | 4380 | **0.096** | 0.306 | | |
| Th-232 series | Ac-228 | **1.11E+00** | **9.82E-01** | **0.129** | 4380 | **0.141** | **Gamma Total Dose** | | |
| U-238 series | Ra-226 | **2.30E+00** | **1.63E+00** | **0.612** | 4380 | **0.004** | 2.450 | | |
| alpha | U-234 | **1.91E-01** | **2.92E-01** | 0.000 | 4380 | 0.000 | **Alpha Avg Dose** | | |
| alpha | U-235[1] | **6.96E-02** | 0.00E+00 | **0.070** | 4380 | **0.010** | 0.003 | | |
| alpha | U-238 | **1.94E-01** | **3.26E-01** | 0.000 | 4380 | 0.000 | **Alpha Total Dose** | | |
| | **Eu-155** | **5.53E-01** | **3.75E-01** | **0.178** | 4380 | **0.007** | 0.011 | | |
| Soil | **Cs-137** | **2.02E-01** | **1.66E-01** | **0.036** | 4380 | 0.000 | | | |
| Sediment | **Cs-137** | **7.30E-01** | **0.00E+00** | **0.730** | 4380 | **0.002** | **Building (beta-gamma)** | | |
| TLD | **beta-gamma** | **9.48E+01** | **9.26E+01** | **2.200** | **mrem** | **2.200** | **104-mrem control** | Ttl NORM dose | |
| Unknown Alpha | **as Pu-239** | **1.54E+01** | **7.65E+00** | **7.735** | 4380 | **0.001** | Avg NORM dose 0.036 | 0.251 | |
| See note* | **Direct Ground Exposure Avg Dose** | | | | **Avg** | 0.205 | 1 mR=1mrem - no identified source. | | |
| **Surface Soil Resuspension** | | **pCi/g** | **pCi/g** | **pCi/g** | **m3/yr** | **mrem** | **Total Soil Resuspension Dose[1,2]** | | **0.00** |
| Th-232 series | Pb-212 | **1.18E+00** | **1.41E+00** | 0.000 | 8000 | 0.000 | **Gamma Avg Dose** | | |
| U-238 series | Pb-214 | **1.06E+00** | **6.85E-01** | **0.377** | 8000 | 0.000 | 0.001 | | |
| Th-232 series | Ac-228 | **1.11E+00** | **9.82E-01** | **0.129** | 8000 | 0.000 | **Alpha Avg Dose** | | |
| U-238 series | Ra-226 | **2.30E+00** | **1.63E+00** | **0.665** | 8000 | 0.005 | 0.479 | | |
| alpha | U-234 | **1.91E-01** | **2.92E-01** | 0.000 | 8000 | 0.000 | **Gamma Total Dose** | | |
| alpha | U-235[1] | **6.96E-02** | 0.00E+00 | **0.070** | 8000 | **0.007** | 0.005 | | |
| alpha | U-238 | **1.94E-01** | **3.26E-01** | 0.000 | 8000 | 0.000 | **Alpha Total Dose** | | |
| | **Eu-155** | **5.53E-01** | **3.75E-01** | **0.178** | 8000 | 0.000 | 1.916 | | |
| Soil | **Cs-137** | **2.02E-01** | **1.66E-01** | **0.036** | 8000 | 0.000 | Avg NORM 0.240 | Ttl NORM dose…… | |
| Sediment | **Cs-137** | **7.30E-01** | **0.00E+00** | **0.730** | 8000 | 0.000 | | 1.921 | |
| Unknown Alpha | **as Pu-239[2]** | **1.54E+01** | **7.65E+00** | **7.735** | 8000 | **1.909** | Resuspension of 6 inch average soil depth unlikely except | | |
| See note* | **Surface Soil Resuspended Avg Dose** | | | | **Avg** | 0.175 | in farming and air filters failed to confirm this resuspension. | | |
| | | | | | | | Total Soil Resuspension Dose not confirmed by Air Inhalation Dose | | |
| **Total Air Inhalation MEI** | | | | | | | | | **0.00** |
| **Air Inhalation** | | **pCi/m3** | **pCi/m3** | **pCi/m3** | **m3/yr** | **mrem** | | | |
| Inhalation | **H-3** | **4.60E+00** | **0.00E+00** | **4.600** | 8000 | **0.002** | | | |
| | **Alpha** | **3.00E-03** | **3.00E-03** | **0.000** | 8000 | 0.000 | | | |
| | **Beta** | **2.10E-02** | **2.40E-02** | 0.000 | 8000 | 0.000 | | | |
| Air Inhalation Average Dose | | | | | **Avg** | **0.001** | **Soil & Air subtotal** | 2.699 | |
| | | | | | | | | **MEI Dose** | **2.23** |
| | | | | | | | | **NORM Total Dose** | **2.20** |
| | | | | | | | | **Total NORM and MEI** | **2.23** |

Notes: see the acronym section for abbreviations.

1. The NORM samples greater than background occurred in flood plain areas downstream from saprolitic gra
2. Total soil resuspension dose not confirmed by air inhalation dose.
3. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
4. TLD dose was re-evaluated in 2006 using only locations with a full year of detected data and subtracted outer perimeter from inner perimeter locations.
5. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## Radiological Dose Calculation Data

Table 14. 2006 MEI Radiation Dose - Detects Only in Food Sources

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | Subtotals for | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Radiation Dose | Dose |
| | | Food Sources | | | | | Average Dose | Totals mrem/species | |
| Fish Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Fish mrem avg/rad | Bass | |
| Bass | H-3 | 8.50E-01 | 5.04E-01 | 0.346 | 48.2 | 0.001 | H-3 avg dose | 0.437 | |
| | Cs-137 | 1.81E-01 | 0.00E+00 | 0.181 | 48.2 | 0.436 | 0.002 | Catfish | |
| | Sr-89/90 | 8.60E-02 | 1.46E-01 | 0.000 | 48.2 | 0.000 | Cs-137 avg dose | 0.192 | |
| | | | | Bass | Avg | 0.146 | 0.262 | Sunfish | |
| Catfish | H-3 | 8.32E-01 | 3.97E-01 | 0.435 | 48.2 | 0.001 | Sr-89/90 avg dose | 0.162 | |
| | Cs-137 | 7.90E-02 | 0.00E+00 | 0.079 | 48.2 | 0.190 | 0.000 | | |
| | Sr-89/90 | 6.00E-02 | 5.90E-02 | 0.001 | 48.2 | 0.001 | All Fish Avg Dose | All Fish Total Dose | |
| | | | | Catfish | Avg | 0.064 | 0.264 | 0.791 | |
| Carp | H-3 | 8.09E-01 | 0.00E+00 | 0.809 | 48.2 | 0.002 | | | |
| | Cs-137 | 6.60E-02 | 0.00E+00 | 0.066 | 48.2 | 0.159 | | | |
| | | | | Carp | Avg | 0.081 | MEI Fish Avg Radioisotope Dose | | |
| | | | | | | | 0.088 | Highest Dose/Rad Ttl | 0.44 |
| Milk Ingestion | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | Milk mrem avg/rad | Milk Maximum Dose--- | |
| Cow | H-3 | 4.86E-01 | 2.99E-01 | 0.187 | 230 | 0.003 | H-3 or tritium | Cow Milk avg dose | |
| | Sr-89/90 | 9.15E-01 | 8.44E-01 | 0.071 | 230 | 0.195 | 0.003 | 0.099 | |
| | Sr-89/90 | Calculated as Sr-90 | | | | | Cs-137 avg dose | Cow Milk total dose | |
| Only detected rads are used in averages. | | | | | | | 0.000 | 0.198 | |
| | | | | Cow Milk | Avg | 0.099 | Sr-89/90 avg dose | | |
| | | | | | Sum | 0.198 | 0.195 | | |
| Subtracted an average of 3 background locations (Mk15,30,99). | | | | | | MEI Milk Radioisope Dose | | | 0.20 |
| | | Average Radionuclide Dose | | | | | | | |
| | | Average | | Average Bkg | | | | | |
| Game Animal | | Dose/Animal | | Dose/Animal | | | No hog samples. | | |
| Ingestion | | mrem | | mrem | | mrem | Deer Avg Dose | | |
| Average Deer | Cs-137 | 1.20E+00 | | 4.390 | | -3.190 | 0 | | |
| | | Maximally Exposed Individual Hunter | | | | | MEI Deer Dose | | |
| MEI Deer | Cs-137 | 5.54E+00 | | 4.39 | | 1.15 | 1.15 | | 1.15 |
| | | pCi/g | pCi/g | pCi/g | kg/yr | mrem | | | |
| Edible Veg (leaves | H-3 | 2.35E-01 | 2.53E-04 | 0.235 | 73 | 0.001 | Veg Avg Dose | Edible Veg Total Dose | |
| Edible Veg (fruits) | H-3 | 3.12E-01 | 0.00E+00 | 0.312 | 276 | 0.006 | 0.003 | 0.007 | 0.01 |
| | | | | | | Total Radiation Detections | | 1.885 | |
| | | | | | | | | Total MEI Food Dose | 1.80 |

*Notes: see the acronym section for abbreviations.

1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
5. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
6. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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# Radiological Dose Calculation Data

Table 15. 2006 MEI Radiation Dose - Detects Only in Water Sources

| Project | Isotope | Avg Activity | Bkg Activity | Net Activity | MCR | Dose mrem | Exposure per Radionuclide and Average Dose | NORM Subtotals for Radiation Dose | MEI Dose (mrem) |
|---|---|---|---|---|---|---|---|---|---|
| Water Sources | | | | | | | | | |
| PWSRW Ingestion | | pCi/L | pCi/L | pCi/L | L/yr | mrem | PWS mrem avg/rad | | |
| Potable | H-3 | 7.10E+02 | 2.05E+02 | 505.000 | 730.000 | 0.024 | Tritium 0.012 | | |
| | Unk Alpha | 2.61E+00 | 2.08E+00 | 0.530 | 730.000 | 0.020 | Alpha 0.031 | | |
| | Unk Beta | 5.04E+00 | 2.47E+00 | 2.570 | 730.000 | 0.022 | Beta 0.011 | | |
| | PWS River Water Average Dose | | | | Avg | 0.022 | Ttl PWSRW 0.066 | | |
| PWSGW Ingestion | | pCi/L | pCi/L | pCi/L | L/yr | mrem | all PWS Total 0.107 | | |
| Potable | H-3 | 2.81E+02 | 3.29E+02 | 0.000 | 730.000 | 0.000 | all PWS Avg 0.018 | | |
| | Unk Alpha | 3.80E+00 | 2.72E+00 | 1.088 | 730.000 | 0.041 | | | |
| | Unk Beta | 3.22E+00 | 4.83E+00 | 0.000 | 730.000 | 0.000 | | | |
| | PWS Ground Water Average Dose | | | | Avg | 0.014 | Ttl PWSGW 0.041 | | |
| DNRGW Ingestion | | pCi/L | pCi/L | pCi/L | L/yr | mrem | | | |
| Possible Dose | H-3 | <mda | 3.29E+02 | 0.000 | 730.00 | 0.000 | | | |
| at Private Wells | Unk Beta | 4.30E+00 | 4.83E+00 | 0.000 | 730.000 | 0.000 | | | |
| in GW area. | Unk Alpha | 6.54E+00 | 2.72E+00 | 3.823 | 730.000 | 0.145 | | | |
| U238 series | Ttl U | 6.60E-01 | 4.60E-01 | 0.200 | 730.00 | 0.037 | DNRGW NORM avg | | |
| U238 series | Ra-226 | 1.24E+00 | 2.50E-01 | 0.990 | 730.00 | 0.958 | 0.367 | | |
| Th232 series | Ra-228 | 4.10E-01 | 3.10E-01 | 0.100 | 730.00 | 0.105 | DNR nonNORM total | | |
| | DNR Ground Water Average Dose | | | | Avg | 0.208 | 0.145 | DNR NORM total | |
| AGMP Wells Average Dose | | | | Avg | 0.249 | | | 1.100 | |
| AGMP Wells Total Dose | | | | Total | 1.245 | | | | |
| Potable Water (PWS) Dose Average | | | | | | 0.018 | | | |
| Nonpotable Water Ingestion | | pCi/L | pCi/L | pCi/L | L/yr | mrem | | Total Boat Landing | |
| SR Boat | H-3 | 5.47E+02 | 2.05E+02 | 342.000 | 730.000 | 0.016 | Sportsman Dose 0.071 | 0.060 | |
| Landings | Unk Alpha | 3.23E+00 | 2.08E+00 | 1.150 | 730.000 | 0.044 | Nonpotable avg 0.018 | | |
| | Unk Beta | 5.96E+00 | 3.75E+00 | 2.213 | 730.000 | 0.000 | Cistern dose 0.011 | | |
| Rainwater | H-3 | 2.40E+02 | 0.00E+00 | 240.000 | 730.000 | 0.011 | MEI Drinking Water Dose (Highest) is from Sportsman | | 0.15 |
| Cannot total doses from more than one DW source unless consumption rate of each is modified. | | | | | | | | | |
| Total Surface Water MEI | | | | | | | | | 0.00 |
| Surface Water | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | | Swimming Ingestion | |
| Ingestion | H-3 | 5.13E+02 | 0.00E+00 | 512.800 | 91 | 0.000 | | 0.000 | |
| while swimming | Alpha | 2.48E+00 | 2.08E+00 | 0.000 | 91 | 0.000 | | | |
| | Beta | 5.65E+00 | 3.75E+00 | 0.000 | 91 | 0.000 | | | |
| Surface Water | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | | Swimming Immersion | |
| Immersion | H-3 | 5.13E+02 | 0.00E+00 | 512.800 | 91 | 0.000 | No H-3 exposure DF | 0.000 | |
| Exposure | Alpha | 2.48E+00 | 2.08E+00 | 0.000 | 91 | 0.000 | | | |
| | Beta | 5.65E+00 | 3.75E+00 | 0.000 | 91 | 0.000 | | | |
| Surface Water | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | | Houseboat Exposure | |
| Boating | H-3 | 5.13E+02 | 0.00E+00 | 512.800 | 192 | 0.000 | No H-3 exposure DF | 0.000 | |
| Exposure | Alpha | 2.48E+00 | 2.08E+00 | 0.000 | 192 | 0.000 | | | |
| | Beta | 5.65E+00 | 3.75E+00 | 0.000 | 192 | 0.000 | | | |
| Surface Water | | pCi/L | pCi/L | pCi/L | hrs/yr | mrem | | Swamp House Exposure | |
| Swamp Dweller | H-3 | 5.13E+02 | 0.00E+00 | 512.800 | 4380 | 0.000 | No H-3 exposure DF | 0.000 | |
| Exposure | Alpha | 2.48E+00 | 2.08E+00 | 0.000 | 4380 | 0.000 | | | |
| | Beta | 5.65E+00 | 3.75E+00 | 0.000 | 4380 | 0.000 | | | |
| | | | | | | | | MEI DW Highest Dose | 0.15 |
| | | | | | | | | Add NORM dose | 1.10 |
| | | | | | | | | Total Dose | 1.25 |

*Notes: see the acronym section for abbreviations.
1. Unknown alpha data calculated as Pu-239.
2. Unknown beta data calculated as Sr-90.
3. MEI DW dose is the highest drinking water dose calculated (which is surface water for Savannah River drinking water suppliers).
4. TLD info based on two quarters of data and not directly comparable to later vendors and sampling, but result is still zero mrem for 1999.
1 mR=1mrem - no identified source.
5. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
6. Game animal collections did not start until year 2000 and were re-evaluated in 2006 for the MEI Sportsman scenario.
7. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.
8. DNR wells make up most of the ambient groundwater monitoring project (AGMP) or network (AGMN).
9. Rainwater cistern dose is based on air station monitoring of rainwater collected locally outside of SRS.
10. Savannah River boat landings (Steel Creek Landing, Little Hell Landing, and Brunson's Ferry) are subject to the use of boiled water by sportsmen.

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# Radiological Dose Calculation Data

Table 16. 2006 MEI Radiation Dose - Detects Only For Soil and Air

| Project | Isotope | Avg | Bkg | Net | MCR | Dose | Exposure | NORM | MEI |
|---|---|---|---|---|---|---|---|---|---|
| | | Activity | Activity | Activity | | mrem | per Radionuclide | Subtotals for | Dose |
| Soil & Sediment (random plus nonrandom samples) | | | | | | | | Radiation Dose | Total |
| **Surface Soil Ingestion** | | **pCi/g** | **pCi/g** | **pCi/g** | **mg/day** | **mrem** | **Total nonNORM Soil Ingestion Dose>Bkg is** | | **0.01** |
| Th-232 series | **Pb-212** | **1.24E+00** | **8.44E-01** | **0.400** | 100 | **0.001** | **Gamma Avg 0.007** | | |
| U-238 series | **Pb-214** | **1.16E+00** | **8.67E-01** | **0.295** | 100 | **0.000** | **Alpha Avg 0.006** | | |
| | **Ra-226** | **3.08E+00** | **2.24E+00** | **0.841** | 100 | **0.041** | **Beta Avg 0.000** | | |
| | **Zn-65** | **1.16E-01** | **0.00E+00** | **0.116** | 100 | **0.000** | | | |
| | **Ac-228** | **1.15E+00** | **1.06E+00** | **0.089** | 100 | **0.000** | **Gamma Total 0.042** | | |
| | **Cs-137** | **5.82E-01** | **2.00E-01** | **0.382** | 100 | **0.001** | **Alpha Total 0.006** | | |
| Unknown Alpha | **as Pu-239** | **1.33E+01** | **9.96E+00** | **3.307** | 100 | **0.006** | **Beta Total 0.001** | | |
| Unknown Beta | **as Sr-90** | **1.28E+01** | **1.17E+01** | **1.133** | 100 | **0.000** | NORM avg | Ttl NORM dose | |
| Sediment | **Beta as Sr-90** | **3.10E+01** | **1.65E+01** | **14.500** | 100 | 0.006 | 0.010 | 0.041 | |
| See note* | **Soil Ingestion Rad Average Dose** | | | | Avg | 0.006 | | | |
| **Surface Soil Exposure** | | **pCi/g** | **pCi/g** | **pCi/g** | **hrs/yr** | **mrem** | **Total Direct Exposure nonNORM Dose>Bkg is** | | **2.52** |
| Th-232 series | **Pb-212** | **1.24E+00** | **8.44E-01** | **0.400** | 4380 | **0.054** | **Gamma Avg 0.051** | | |
| U-238 series | **Pb-214** | **1.16E+00** | **8.67E-01** | **0.295** | 4380 | **0.075** | **Alpha Avg 0.000** | | |
| | **Ra-226** | **3.08E+00** | **2.24E+00** | **0.841** | 4380 | **0.005** | **Beta Avg 0.001** | | |
| | **Zn-65** | **1.16E-01** | | **0.116** | 4380 | **0.073** | | | |
| | **Ac-228** | **1.15E+00** | **1.06E+00** | **0.089** | 4380 | **0.097** | **Gamma Total 0.306** | | |
| | **Cs-137** | **5.82E-01** | **2.00E-01** | **0.382** | 4380 | **0.001** | **Alpha Total 0.000** | | |
| Unknown Alpha | **as Pu-239** | **1.33E+01** | **9.96E+00** | **3.307** | 4380 | **0.000** | **Beta Total 0.001** | | |
| Unknown Beta | **as Sr-90** | **1.28E+01** | **1.17E+01** | **1.133** | 4380 | **0.001** | | | |
| Sediment | **Beta as Sr-90** | **3.10E+01** | **1.65E+01** | **14.500** | 4380 | 0.007 | NORM Avg 0.471 | Total NORM | |
| TLD dose not confirmed by nonNORM detections (e.g. Cs-137, Pu-239, Sr-90). | | | | | | | **Building (beta-gamma)** | 0.305 | |
| TLD[1] | **beta-gamma** | **8.92E+01** | **8.67E+01** | **2.520** | **mrem** | **2.520** | **98-mrem control** | | |
| No reduction factors or source assumptions assigned for unknown beta-gamma. | | | | | | | | | |
| See note* | **Direct Ground Exposure Avg Dose** | | | | Avg | 0.283 | | | |
| **Surface Soil Resuspension** | | **pCi/g** | **pCi/g** | **pCi/g** | **m3/yr** | **mrem** | **Ttl nonNORM Soil Resuspension Dose** | | |
| Th-232 series | **Pb-212** | **1.24E+00** | **8.44E-01** | **0.400** | 8000 | 0.000 | **Gamma Avg 0.001** | | |
| U-238 series | **Pb-214** | **1.16E+00** | **8.67E-01** | **0.295** | 8000 | 0.000 | **Alpha Avg 0.816** | | |
| | **Ra-226** | **3.08E+00** | **2.24E+00** | **0.841** | 8000 | **0.006** | **Gamma Total 0.006** | | |
| | **Zn-65** | **1.16E-01** | | **0.116** | 8000 | **0.000** | **Alpha Total 0.816** | | |
| | **Ac-228** | **1.15E+00** | **1.06E+00** | **0.089** | 8000 | 0.000 | Resuspended nonNORM assigned as NORM since | | |
| | **Cs-137** | **5.82E-01** | **2.00E-01** | **0.382** | 8000 | **0.000** | air filter results did not collect the potential resuspension. | | |
| Unknown Alpha | **as Pu-239** | **1.33E+01** | **9.96E+00** | **3.307** | 8000 | **0.816** | 0.832 | | |
| Unknown Beta | **as Sr-90** | **1.28E+01** | **1.17E+01** | **1.133** | 8000 | **0.001** | Avg NORM dose | Ttl NORM dose | |
| Sediment | **Beta as Sr-90** | **3.10E+01** | **1.65E+01** | **14.500** | 8000 | 0.015 | 0.137 | 0.838 | |
| Resuspension of 6 inch average soil depth unlikely except in farming, and air filters failed to confirm this resuspension as nonNORM. | | | | | | | | | |
| | | | | | | | Soil Total Dose-1.344 | | |
| See note* | **Surface Soil Resuspended Avg Dose** | | | | Avg | 0.093 | | | |
| **Total Air Inhalation MEI** | | | | | | | | | |
| **Air Inhalation** | | **pCi/m3** | **pCi/m3** | **pCi/m3** | **m3/yr** | **mrem** | | **Air Total Dose** | **0.01** |
| Inhalation | **H-3** | **4.63E+00** | 0.00E+00 | **4.626** | 8000 | **0.002** | **Air monitors did not pick up the large** | | |
| | **Alpha** | **3.06E-03** | **3.83E-03** | **0.000** | 8000 | 0.000 | **unknown alpha theoretical resuspension** | | |
| | **Beta** | **2.35E-02** | **2.32E-02** | **0.000** | 8000 | **0.003** | **based on Pu-239.** | | |
| | | | | | | | **Total Air 0.005** | | |
| | Air Inhalation Average Dose | | | | **Avg** | **0.002** | **Soil & air subtotal** | 1.170 | |
| | | | | | | | | **MEI Dose** | **2.54** |
| | | | | | | | | **NORM Total Dose** | **1.17** |
| | | | | | | | | **Total NORM and MEI** | **3.71** |

Notes: see the acronym section for abbreviations.

1. The NORM samples greater than background occurred in flood plain areas downstream from saprolitic granite
2. A lab error in the gross alpha determination took place due to delayed analysis time.
3. K-40 exposure is not calculated due to the typical addition of fertilizers to soil, which biases dose results for plants, soil, and water runoff.
4. TLD dose was re-evaluated in 2006 using only locations with a full year of detected data and subtracted outer perimeter from inner perimeter locations.
5. Updated dose factors and reanalyzed dose in 2006 for dose trending with same factor basis throughout past years.

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## 6.1.5 Summary Statistics
## Radiological Dose Calculation

**Table 1. SCDHEC Potential Dose Scenarios**

| | 2006 | 1999-2006 | | |
|---|---|---|---|---|
| | | Average | Standard Deviation | Median |
| MEI [1] Sportsman | 4.49 | 12.28 | 11.54 | 9.62 |
| Public[2] | 0.37 | 0.13 | 0.12 | 0.09 |
| Farmer [3] | 2.9 | 0.96 | 1.26 | 0.11 |
| Average[4] Sportsman | 3.34 | 2.42 | 1.76 | 2.32 |

Notes: NORM was excluded.

1. The maximum exposed individual (MEI) is the worst-case scenario for a single hunter that also uses the worst-case ingestion dose from all sampled water sources.
2. The non-sportsman public dose deletes sports food, sediments, and soil and adds the highest public or private water source dose.
3. The farmer scenario adds the sediments, soil, and highest well water dose to #2.
4. The average sportsman replaces the MEI deer dose with average deer dose and uses the highest public or private water source dose.

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# Summary Statistics
# Radiological Dose Calculation

Table 2. Average Dose (millirem) Rank by Radionuclide

| 1999-2006 | Sum | Avg | SD | Median | %of Total | 2006 | Sum | Avg | SD | Median | %of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cs-137** | 13.52 | 0.56 | 0.99 | 0.24 | 42.39 | b-gamma | 2.52 | 2.52 | | 2.52 | 41.18 |
| b-gamma | 6.69 | 0.84 | 1.16 | 0.00 | 20.97 | alpha | 1.07 | 0.27 | 0.38 | 0.12 | 17.52 |
| alpha | 5.57 | 0.37 | 0.74 | 0.04 | 17.45 | Ra-226 | 1.01 | 0.51 | 0.64 | 0.51 | 16.50 |
| Ra-226 | 3.54 | 0.59 | 0.63 | 0.51 | 11.10 | **Cs-137** | 0.79 | 0.26 | 0.45 | 0.00 | 12.86 |
| **H-3** | 0.58 | 0.01 | 0.01 | 0.01 | 1.82 | **Sr-89/90** | 0.20 | 0.10 | 0.14 | 0.10 | 3.20 |
| **Sr-89/90** | 0.44 | 0.11 | 0.12 | 0.10 | 1.37 | Ra-228 | 0.11 | 0.11 | | 0.11 | 1.72 |
| Ac-228 | 0.35 | 0.12 | 0.02 | 0.11 | 1.09 | Ac-228 | 0.10 | 0.10 | | 0.10 | 1.58 |
| Pb-214 | 0.22 | 0.07 | 0.03 | 0.08 | 0.68 | Pb-214 | 0.08 | 0.08 | | 0.08 | 1.23 |
| **Sr-89** | 0.19 | 0.06 | 0.09 | 0.01 | 0.58 | **Zn-65** | 0.07 | 0.07 | | 0.07 | 1.19 |
| Ra-228 | 0.19 | 0.09 | 0.02 | 0.09 | 0.58 | **H-3** | 0.07 | 0.01 | 0.01 | 0.00 | 1.13 |
| **U-234** | 0.15 | 0.15 | | 0.15 | 0.46 | Pb-212 | 0.06 | 0.06 | | 0.06 | 0.90 |
| **Eu-155** | 0.12 | 0.06 | 0.07 | 0.06 | 0.37 | **U-238** | 0.04 | 0.04 | | 0.04 | 0.60 |
| beta | 0.09 | 0.01 | 0.01 | 0.01 | 0.28 | beta | 0.03 | 0.01 | 0.01 | 0.00 | 0.44 |
| Pb-212 | 0.09 | 0.05 | 0.01 | 0.05 | 0.28 | **Sr-89** | 0.00 | | | | 0.00 |
| **Zn-65** | 0.07 | 0.07 | | 0.07 | 0.23 | **Sr-90** | 0.00 | | | | 0.00 |
| **U-238** | 0.06 | 0.01 | 0.01 | 0.01 | 0.19 | **U-234** | 0.00 | | | | 0.00 |
| **U-235** | 0.03 | 0.01 | 0.00 | 0.01 | 0.08 | **U-235** | 0.00 | | | | 0.00 |
| **Sr-90** | 0.01 | 0.01 | 0.00 | 0.01 | 0.04 | **Pu-239/24** | 0.00 | | | | 0.00 |
| **Ce-144** | 0.00 | 0.00 | | 0.00 | 0.01 | **Am-243** | 0.00 | | | | 0.00 |
| **Am-243** | 0.00 | 0.00 | | 0.00 | 0.01 | **Pu-238** | 0.00 | | | | 0.00 |
| **Pu-239/240** | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | **Pu-239** | 0.00 | | | | 0.00 |
| **Pu-238** | 0.00 | 0.00 | | 0.00 | 0.00 | **Ce-144** | 0.00 | | | | 0.00 |
| **Tc-99** | 0.00 | 0.00 | | 0.00 | 0.00 | **Tc-99** | 0.00 | | | | 0.00 |
| **Pu-239** | 0.00 | | | | 0.00 | **Eu-155** | 0.00 | | | | 0.00 |
| **Totals** | 31.90 | | | | 100.01 | | 6.12 | | | | 100.05 |

Notes:
1. This table uses average deer and hog dose and not MEI deer and hog dose.
2. Previous data submission errors are corrected in this table.
3. Most alpha and beta detections resulted from the assignment of unknown alpha as Pu-239 and unknown beta as Sr-90.
4. Detections of 0.00 were less than 0.005 mrem, and grey areas are not applicable.
5. Bold type indicates potentially nonNORM radionuclides based on media locations and other factors.
6. Nonbold type indicates potentially NORM radionuclides based on media locations and other factors.
7. TLD b-gamma are based on 1 mR (milliroentgen) = 1 mrem (millirem).

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## Summary Statistics
## Radiological Dose Calculation

| Table 3. 1999-2006 SCDHEC Detected Dose in Millirem Within 50 Miles of the SRS (Excluding NORM) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year | | | | | | | | 8 Yr. | % ALL[1] Media | | 1999-2006 Statistics | | |
| Media | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Totals | Avg | MEI | Avg. | SD | Median |
| Surface Water[2] | 0.04 | 0.09 | 0.03 | 0.05 | 0.07 | 0.04 | 0.06 | 0.06 | 0.45 | 2.23 | 0.45 | 0.06 | 0.02 | 0.06 |
| DNRGW[3] | | | | | 0.02 | 0.05 | 0.01 | 0.15 | 0.22 | 1.10 | 0.22 | 0.06 | 0.07 | 0.03 |
| PWSGW[4] | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.05 | 0.04 | 0.04 | 0.17 | 0.83 | 0.17 | 0.02 | 0.02 | 0.02 |
| PWSRW[5] | 0.03 | 0.03 | 0.01 | 0.02 | 0.03 | 0.01 | 0.06 | 0.07 | 0.26 | 1.29 | 0.26 | 0.03 | 0.02 | 0.03 |
| Rainwater | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | 0.09 | 0.42 | 0.09 | 0.01 | 0.01 | 0.01 |
| Soil | 0.00 | 0.01 | 0.01 | 0.00 | 0.02 | 0.02 | 0.02 | 0.01 | 0.09 | 0.45 | 0.09 | 0.01 | 0.01 | 0.01 |
| Sediment | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| TLD[6] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.97 | 2.20 | 2.52 | 6.69 | 33.38 | 6.77 | 0.84 | 1.16 | 0.00 |
| Air | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.06 | 0.31 | 0.06 | 0.01 | 0.01 | 0.01 |
| Vegetables | | | | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.03 | 0.16 | 0.03 | 0.01 | 0.00 | 0.01 |
| Milk | 0.04 | 0.05 | 0.00 | 0.00 | 0.09 | 0.18 | 0.00 | 0.20 | 0.56 | 2.80 | 0.57 | 0.07 | 0.08 | 0.05 |
| Fish | 1.08 | 0.32 | 0.27 | 0.61 | 0.30 | 0.44 | 0.62 | 0.44 | 4.08 | 20.37 | 4.13 | 0.51 | 0.27 | 0.44 |
| Avg Deer[7] | | 0.27 | 0.08 | 1.35 | 0.21 | 0.84 | 0.00 | 0.00 | 2.75 | 13.72 | | 0.39 | 0.51 | 0.21 |
| Avg Hog[7] | | 0.97 | 0.00 | 3.62 | | | | | 4.59 | 22.90 | | 1.53 | 1.87 | 0.97 |
| | Total for media averages > background[10] | | | | | | | | 20.04 | | | Avg. | SD | Median |
| MEI Deer[8] | | 6.18 | 8.36 | 20.25 | 5.58 | 15.74 | 7.64 | 1.15 | 64.90 | | 65.66 | 9.27 | 6.52 | 7.64 |
| MEI Hog[8] | | 4.29 | 0.00 | 16.95 | | | | | 21.24 | | 21.49 | 7.08 | 8.81 | 4.29 |
| Food Media[9] | Total for all MEI averages>background[10] | | | | | | | | 98.84 | | | Avg. | SD | Median |
| MEI Sportsman Avg | 1.08 | 3.60 | 2.88 | 12.60 | 2.94 | 8.09 | 4.13 | 0.80 | 36.11 | | | 4.51 | 3.96 | 3.27 |
| MEI Sportsman Total | 1.08 | 10.79 | 8.63 | 37.81 | 5.88 | 16.18 | 8.26 | 1.59 | 90.22 | | | 11.28 | 11.78 | 8.45 |
| Nonsportsman Food Avg | 0.04 | 0.05 | 0.00 | 0.00 | 0.05 | 0.10 | 0.00 | 0.11 | 0.34 | | | 0.04 | 0.04 | 0.05 |
| Nonsportsman Food Total | 0.04 | 0.05 | 0.00 | 0.00 | 0.10 | 0.19 | 0.00 | 0.21 | 0.59 | | | 0.07 | 0.08 | 0.05 |
| | MEI Scenarios[11] | | | | | | | | Totals | | Years | Avg. | SD | Median |
| MEI Sportsman [11a] | 1.18 | 10.95 | 8.68 | 37.86 | 6.08 | 18.41 | 10.55 | 4.49 | 98.21 | | 1999-06 | 12.28 | 11.54 | 9.62 |
| General Public[11b] | 0.09 | 0.09 | 0.02 | 0.02 | 0.14 | 0.24 | 0.07 | 0.37 | 1.04 | | 1999-06 | 0.13 | 0.12 | 0.09 |
| Farmer[11c] | 0.06 | 0.07 | 0.03 | 0.00 | 0.15 | 2.23 | 2.27 | 2.90 | 7.72 | | 1999-06 | 0.96 | 1.26 | 0.11 |
| Average Sportsman[11d] | 1.18 | 1.72 | 0.40 | 5.63 | 0.66 | 3.51 | 2.91 | 3.34 | 19.36 | | 1999-06 | 2.42 | 1.76 | 2.32 |
| Additional NORM[12] | 0.00 | 0.00 | 0.00 | 0.00 | 1.20 | 2.62 | 3.60 | 2.27 | 9.69 | | 1999-06 | 1.21 | 1.45 | 0.60 |
| NORM plus MEI[13] | 1.18 | 10.95 | 8.68 | 37.86 | 7.28 | 21.03 | 14.15 | 6.76 | 107.91 | | 1999-06 | 13.49 | 12.99 | 10.22 |

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# Summary Statistics
# Radiological Dose Calculation

**Notes: The 2006 graphs and tables represent a re-evaluation of past years TLD, soil, game animal, and rainwate**
**1. % (Percent) of all media means all drinking water dose sources are included in the total dose and media categ**
**are divided by either the media average or an average including the MEI sportsman dose. This biases the total d**
**the highside due to multiple source consumptions at the same maximum consumption rate.**
**Rainwater data were re-analyzed and included as a possible drinking water ingestion source from cisterns.**
**2. Surface water sportsman expousre at the Savannah River boat landings is due to boiling river water for cooki**
**3. DNRGW is the Department of Natural Resources groundwater wells as possible exposure for private wells.**
**The NORM data (1999 through 2002) will be re-evaluated in the 2007 report to represent all dose including NOR**
**Past reports were concerned only with possible dose from SRS.**
**4. PWSGW refers to the dose from public water systems using groundwater.**
**5. PWSRW refers to the dose from public water systems using Savannah River Water downstream of SRS.**
**6. TLD refers to thermoluminescent dosimeter detections of beta-gamma.**
**Change - The subtraction of an outer ring of TLD data (only locations with no missing or stolen TLDs)**
**from an inner ring of TLD data locations along the SRS perimeter gives a more realistic assessment of the dose**
**difference than the use of a single background location, which may have been biased by nearby buildings materia**
**7. Avg Deer and Hog dose is based on the subtraction of avg background dose from the avg perimeter dose.**
**8. MEI Deer or Hog refers to the maximum possible dose consumed by a single hunter.**
**Older reports of deer and hog data combined as game animal were analyzed separately**
**to represent the worst-case MEI Sportsman who consumed all of the worst-case deer and hog dose.**
**9. Food Media compares the general public average and total dose from vegetable and milk consumption**
**to the sportsman consumption of fish and game animals sampled (deer/hog).**
**10. The % of ALL Media "Avg" column is contrasted with the % of ALL Media "MEI" column, which are base**
**on dividing by different totals that used average game animal (deer and hog) versus MEI game animal dose.**
**11. MEI Scenarios use the maximum possible dose (bold numbers) from one drinking water source along with**
**the other media that apply to that scenario.**
**11a. The MEI Sportsman scenario includes the highest drinking water dose (bold numbers), plus the**
**soil media rows through the fish media rows, plus the MEI game animal (MEI hog plus deer) dose.**
**11b. The General Public scenario includes only the nonsportsman dose encountered by the general public, i.e., t**
**air, vegetable, milk, and highest drinking water dose (except the nonpotable surface water dose at boat landings).**
**11c. The Farmer scenario adds the soil, sediment, and the highest groundwater dose to the General Public Scena**
**11d. The Average Sportsman scenario replaces the MEI game animal (worst-case possible dose) with the averag**
**above background for all deer sampled.**
**12. Additional NORM refers to detected dose that was probable NORM.**
**13. The NORM plus MEI dose detections or the total detected dose above background regardless of source.**
**The summary statistics for the 2006 and 1999-2006 data are in the right side columns for the referenced rows.**
**14. The 1999-2002 data were re-evaluated using the dose factors used since 2003, and known errata were correct**
**This resulted in small changes to some media dose(rounding), rainwater, and the correction of some media error**
**15. The assignment of the NORM designation is explained under the applicable media result description.**
**Some general observations are given below.**
**15a. NORM that occurs in upgradient wells coupled with distance from recharge areas, and the lack of air samp**
**detections of resuspended soil potential dose supported the exclusion of certain detections as probable NORM.**
**15b. The Avg Sportsman represents a more realistic potential dose than the MEI Sportsman dose based on extre**
**15c. The median may be a better indicator of the central tendency in environmental dose for all scenarios**
**due to the reasons stated in this report, and the average represents a more conservative estimate.**
**16. Previously reported lab error for air inhalation applied only to alpha determination hold times and not to sp**
**radionuclide determinations.**

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# Errata

From 2005 Report

The following information was reported incorrectly in the *Environmental Surveillance and Oversight Program Data Report for 2005*.

- Chapter 2, pages 106-113
  The mercury MDL for non-radiological surface water was entered as 0.002 mg/L. The MDL should be 0.00020 mg/L.

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